electrical contracting

Industrial Electrification SECTION

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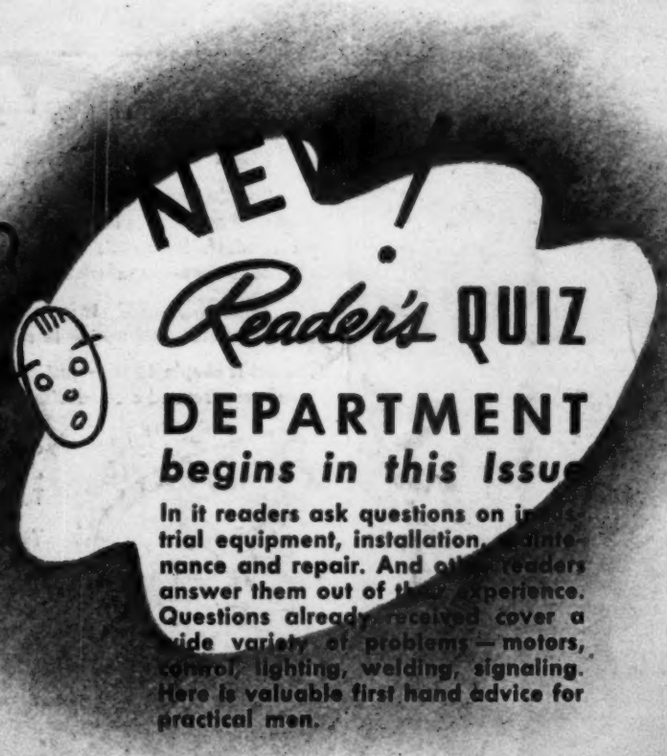
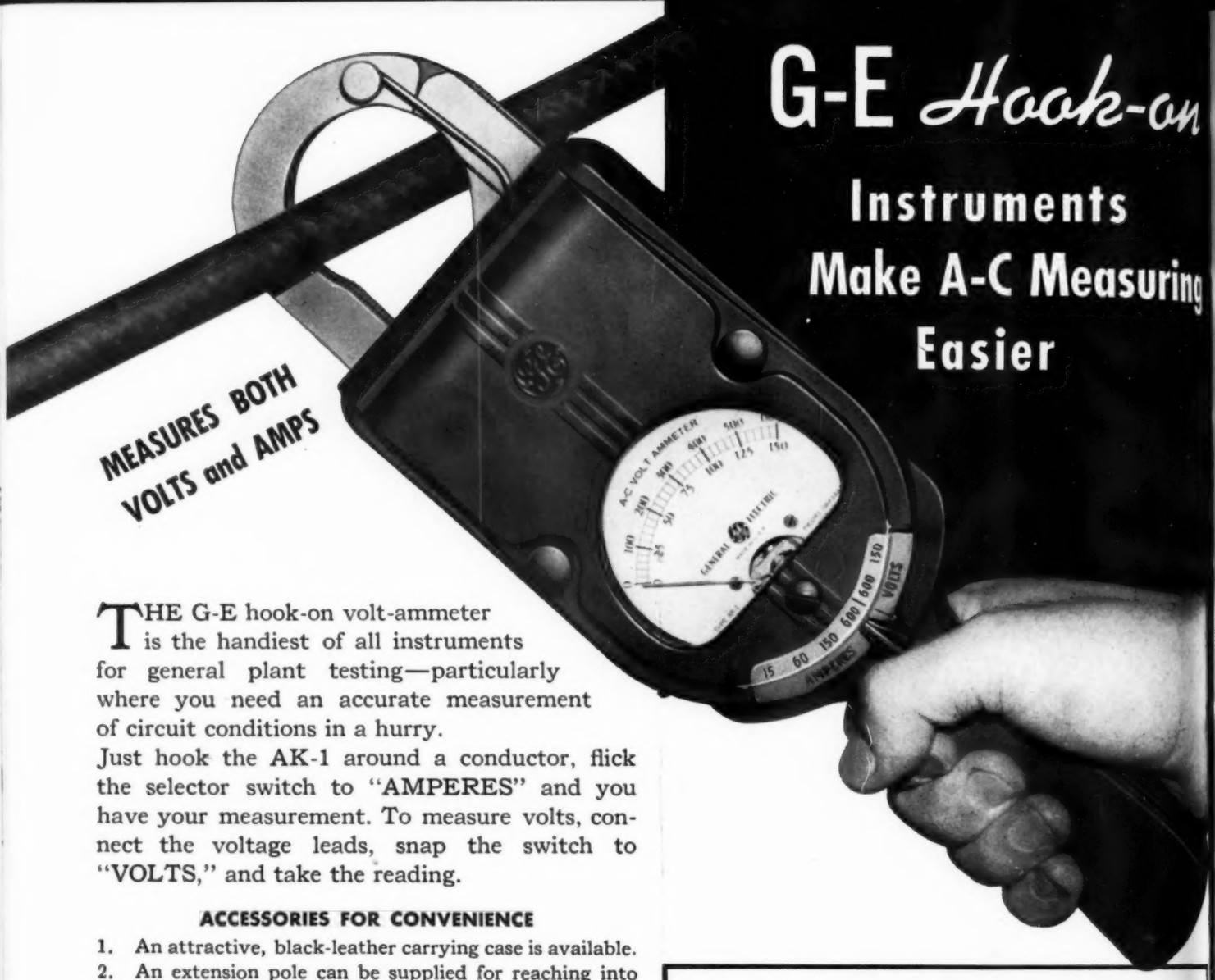

NEW!
Reader's QUIZ
DEPARTMENT
begins in this Issue
In it readers ask questions on industrial equipment, installation, maintenance and repair. And other readers answer them out of their experience. Questions already received cover a wide variety of problems — motors, control, lighting, welding, signaling. Here is valuable first hand advice for practical men.

APRIL
1941

G-E *Hook-on* Instruments Make A-C Measuring Easier



THE G-E hook-on volt-ammeter is the handiest of all instruments for general plant testing—particularly where you need an accurate measurement of circuit conditions in a hurry.

Just hook the AK-1 around a conductor, flick the selector switch to "AMPERES" and you have your measurement. To measure volts, connect the voltage leads, snap the switch to "VOLTS," and take the reading.

ACCESSORIES FOR CONVENIENCE

1. An attractive, black-leather carrying case is available.
2. An extension pole can be supplied for reaching into inaccessible places and for additional protection on high-voltage circuits.
3. Voltage leads are included with each instrument.

AND A LOW-COST HOOK-ON RECORDER FOR CONTINUOUS RECORDS

For trouble investigations and maintenance — where a permanent record of a-c circuits is needed—this G-E hook-on current-measuring set is ideal. It consists of a Type CF-1 recording ammeter and a split-core current transformer.

IT'S INKLESS—ready to go at a moment's notice—no inkwell to fill, no pen to start, and no ink to spill and blur the record.

The set is simple to use—just connect the CF-1, close the jaws of the transformer around a conductor, and it starts to record. The instrument operates without attention and has a 30-day chart length. Timing of the chart drive is accurately controlled by a Telechron motor.

Type CF-1 inkless recording voltmeters are also available.

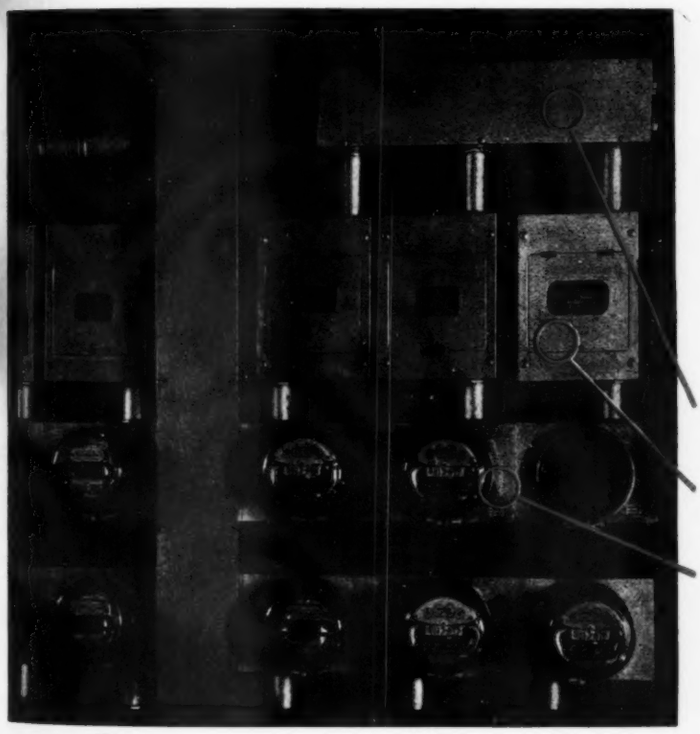
For further information on the hook-on voltammeter, ask for Bulletin GEA-2950; on the recorder, GEA-3187. Your G-E office has copies, or write to General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

602-20

GO all-Murray for EASE, SPEED, GOOD LOOKS *and* PROFITS!

Easy installation—besides other valuable advantages—is the chief (and most popular) characteristic of Murray Electric Service Equipment. Unless you've used Murray wiring Troughs, Socket-Meter Troughs and Combination Main Service and Range Switches complete with Lighting Circuits, you have no idea *how fast* your men can complete even the most complicated layout. Send the coupon for information that means profits in your pockets. Metropolitan Device Corporation, Brooklyn, N. Y.



- **Murray Wiring Troughs—any number of aluminized steel units hitched together in a jiffy. Plenty of knockouts on top, sides and bottom. 4 lengths in each of 4 widths.**
- **Murray Switches—in single, aluminized steel cabinet—Bakelite pull-out type Main Service and Range Switches, complete with lighting circuits. Quickly installed.**
- **Murray Socket Meter Troughs—just as easy to hitch together as the wiring troughs. Come in aluminized steel units of one, two, three or four, usable together or separately.**

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Brooklyn, N. Y.

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Company_____

Address_____

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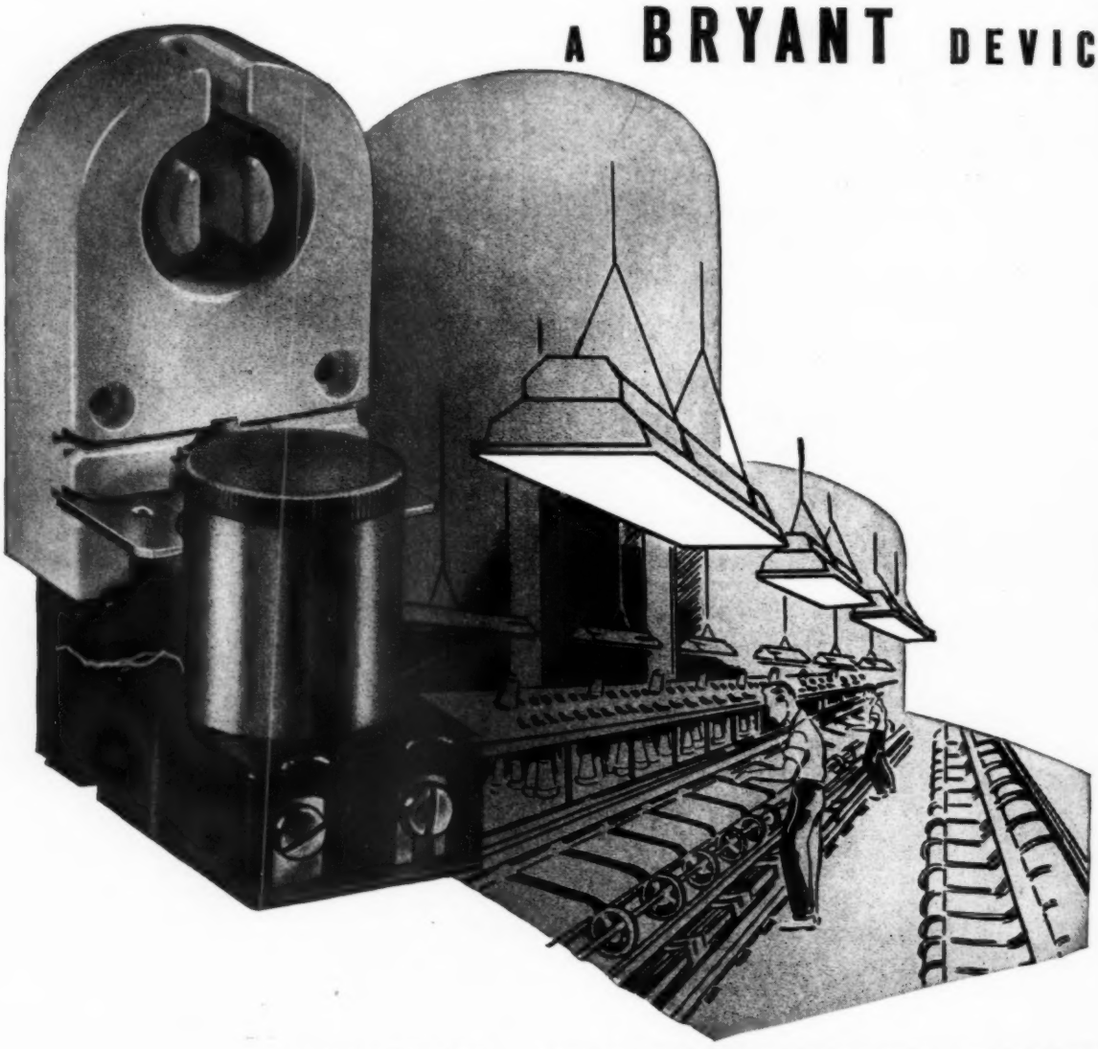
EVERY OUTLET DESERVES

A BRYANT DEVICE



MOGUL FLUORESCENT DEVICES

A Really Complete Line For 60-Inch 100-Watt and 36-Inch 65-Watt Fluorescent Lamps. Designed for Wiring Facility and Trouble-Free Performance.

1. RUGGED BODY—Made of especially selected plastic material.

2. FIRM CONTACT—Assured by use of correctly designed bronze contacts.

3. FLEXIBLE MOUNTING — Metal bracket for panel mounting. May be omitted for surface mounting, in which case two holes in body are used.

4. REVERSIBLE STARTER SOCKET—Furnished with starter socket in usual position as shown or reversed for bottom insertion of starter. Starter sockets made in 2-pin and 4-pin types. The 4-pin type will take either 2-pin starters or 4-pin starters.

5. 2-PIN AND 4-PIN STARTERS — Starters made in 2-pin and 4-pin types for either 100-watt or 65-watt lamps.

6. IDENTIFIED TERMINALS—Screw terminals of different colored metals to assist in proper wire connection.

BRYANT

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COMPLETE CATALOG INFORMATION GLADLY SENT UPON REQUEST

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Bridgeport, Connecticut

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SOLD THROUGH ELECTRICAL WHOLESALERS NATIONALLY

Since 1901 a subsidiary of WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

AS POWER LINE PETE SEZ:

Order From Your Wholesaler

NON-RAVELING
STRAIGHT TEARING
HIGH TENSILE STRENGTH
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STRONG ADHESION

UNITED STATES RUBBER COMPANY
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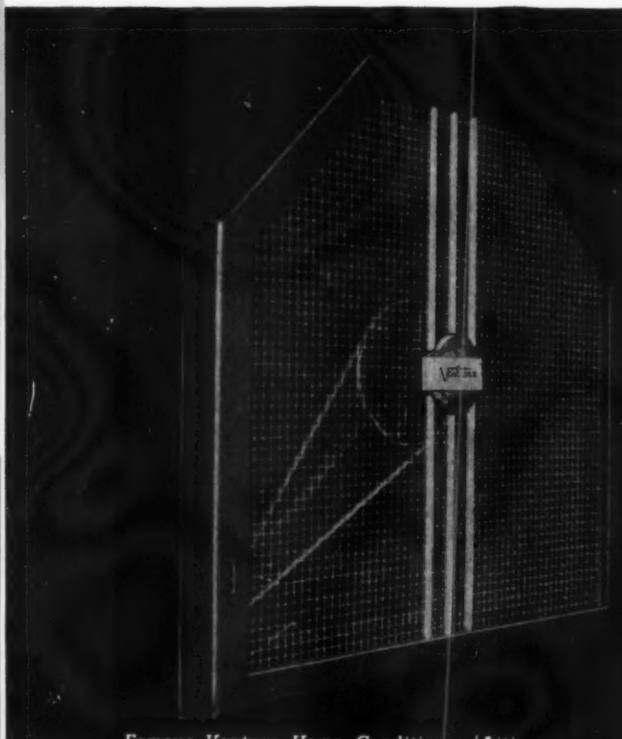
Also Manufacturers of U. S. Electrical Wires and Cables

The PROFITS in Comfort Cooling will



Famous Ventura Home Conditioner (Attic Fan), above. Thousands are now in use.

Above—the new, high quality, economically priced Ventura Attic Fan—greatest value in American Blower history.

POP

Are you making money?

With your present business, even if you work your head off, can you make anything more than just a living?

Have you investigated the profit possibilities in Comfort Cooling with American Blower equipment?

The American Blower line is the most complete in the industry. It enables a dealer to sell homes, factories, commercial establishments, restaurants, offices, etc., products that they need and want.

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AMERICAN BLOWER

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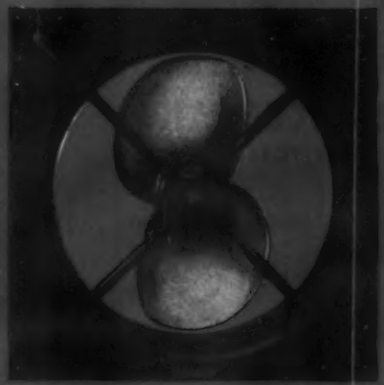
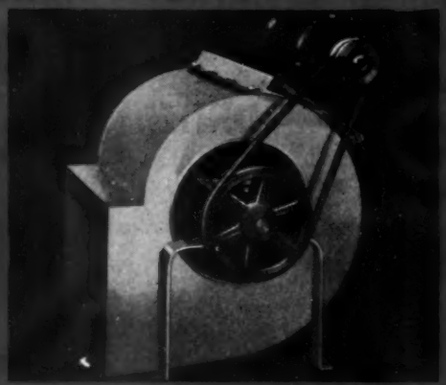
You can sell American Blower Products on F.H.A. Pay-By-The-Month Plan through The Heating & Plumbing Finance Corporation



Ventura Fan, direct connected, for industrial and commercial use.



The AC Fan, for air conditioning work and fresh air supply.

Commercial Ventura Fan, V-Belt Drive for industrial and commercial use.

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Sales assistance through 58 branch offices located in principal cities.

Write for copy of our sales plans NOW!

American Blower's reputation for high quality is backed by over 60 years' experience building all types of ventilating, heating, air conditioning and allied equipment Over 58 branch offices in principal cities.

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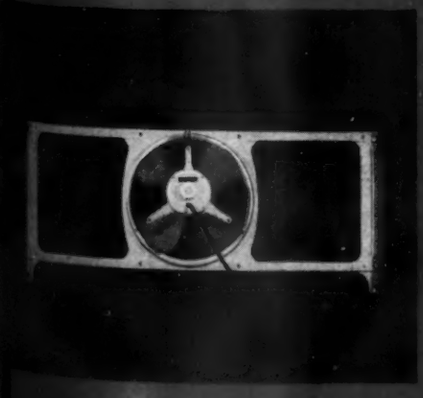
AMERICAN BLOWER
FLUID DRIVES · DUST COLLECTORS



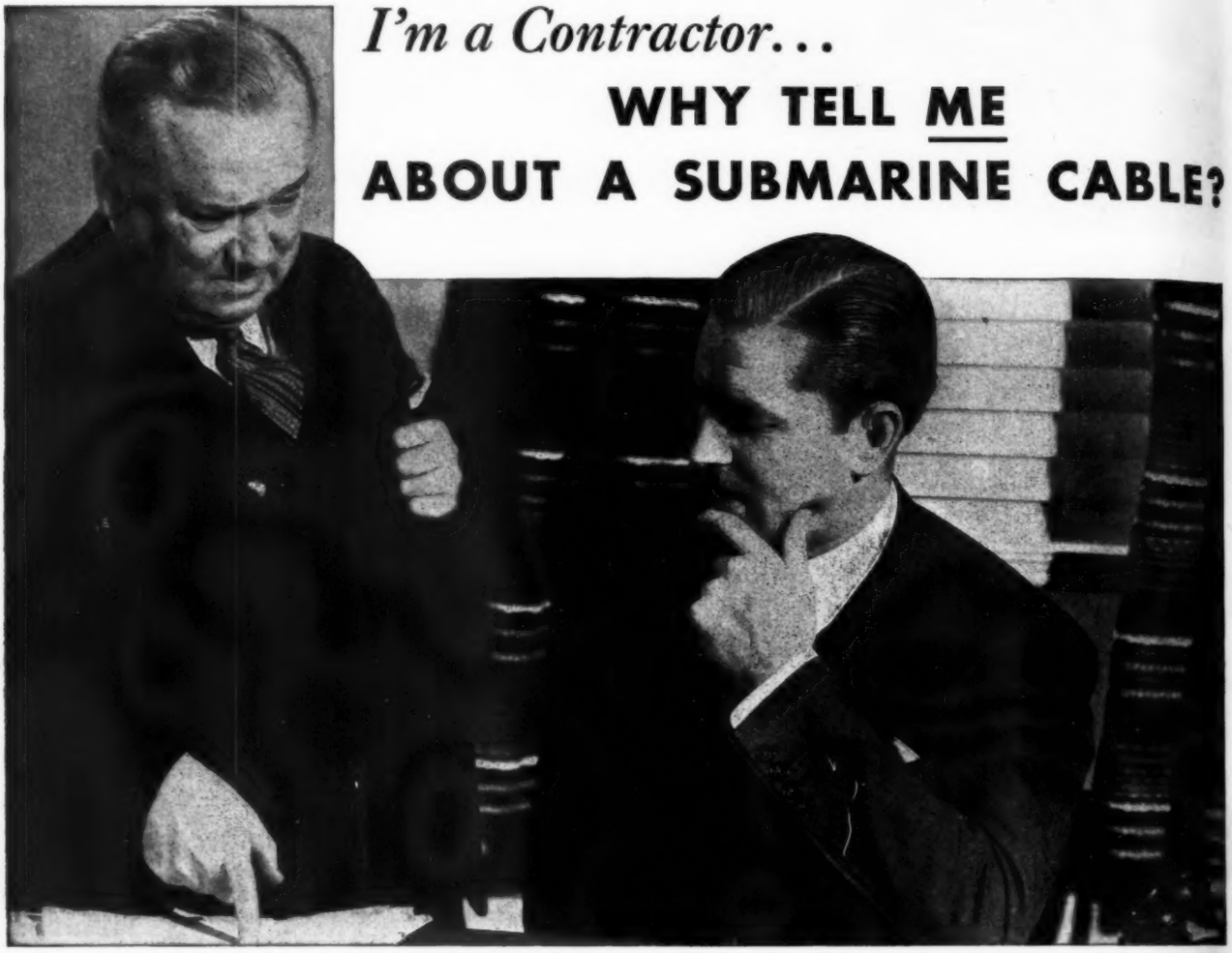
Famous reversible electric ventilator, fits into a window.

ABC Utility Set, a complete, packaged unit for use with ducts.

NOW—TODAY! . . . Line yourself up with the greatest, most complete line of Comfort Cooling and Electric Ventilation products ever offered by American Blower . . . All top quality products, nationally advertised, nationally known. Any aggressive, intelligent concern can organize for year-round, successful sales and service of this complete line for homes, stores and industries within a few weeks. But the peak season is not far off! Act now!

I'm a Contractor...

WHY TELL ME ABOUT A SUBMARINE CABLE?



HERE'S WHY — Because a submarine cable encounters the same conditions, in exaggerated degree, that tend to destroy wires and cables in building service. A submarine cable must withstand constant immersion in water and direct burial in earth and mud of all conditions of alkalinity or acidity. Its shore ends must withstand exposure to air and sunlight, in extremes of temperature.

Building wires, too, must be able to withstand water, earth, acids and alkalies, though not to the same degree as submarine cables.

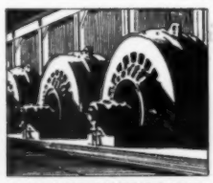
That's why it's important to you to know that the world's first non-leaded submarine power cable, engineered and manufactured by American Steel and Wire Company, and laid in 1909, is still in perfect operating condition after 32 years of service. No other non-leaded submarine power cable can even approach this service record.

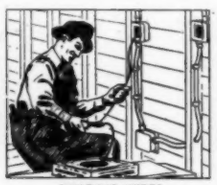
As an electrical contractor remarked when told about that cable: "When a company can produce cables for that kind of service, I know they won't have any difficulty in supplying me with A-1 wires for my building jobs." Write today for data.

ADEQUATE WIRING SERVES AND SAVES

TREE WIRE

PARKWAY CABLES


VARNISHED CAMBRIC CABLES


BUILDING WIRES

SERVICE ENTRANCE AND DROP CABLES

AMERCLAD CORDS & CABLES

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

United States Steel Export Company, New York

UNITED STATES STEEL

STORE FRONT LIGHTING JOBS ARE EASIER TO GET

WITH

SANGAMO

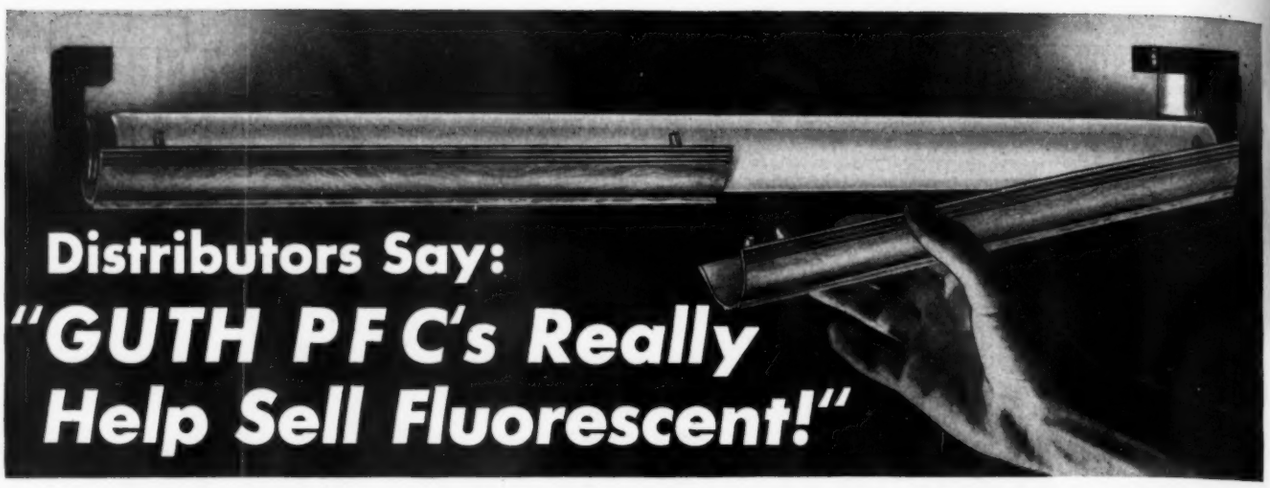
TIME SWITCHES

Sterling Reflector Photos

Right now, retail business is good. Store owners are making money. With a little salesmanship on your part they will be willing to spend it. Start by selling them Sangamo Time-Switches. Their many advantages — convenience, punctuality, and dependability — make Sangamo Time-Switches particularly suitable for use as a "leader" for this purpose. Later, you can get into bigger work, new wiring, fixtures, reflectors — eventually complete lighting modernization of store fronts and interiors. If you want profitable, non-competitive lighting jobs, start by selling Sangamo Time-Switches.

Form KAZ, Astronomic Dial Time-Switch, is completely automatic. No resetting the year around.

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS



Distributors Say: "GUTH PFC's Really Help Sell Fluorescent!"

Only GUTH Offers You the EXTRA SALES HELP of PFC's!

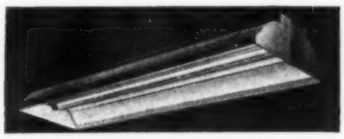
Read This Typical Letter from a Distributor:

"We have a great deal of success with the GUTH PFC Plastic Diffuser in our territory, especially with the local Gas and Electric Company. The head of the lighting department is very favorable toward fluorescent lighting, but has frowned on the glare that so often accompanies poor fluorescent installations.

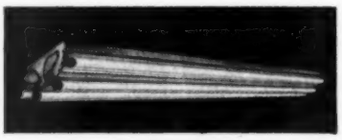
"As a result, their salesmen are now carrying GUTH PFC's with them as THE ANSWER TO A MAIDEN'S PRAYER! We have their complete support and expect a great deal of business on this item here.

"The power company feels that PFC Plastic Diffusers are very adaptable to all types of installations that have too much glare. These installations reflect adversely on the future installations of fluorescent units so, by reducing the glare of installations already in, they are creating sales for new installations."

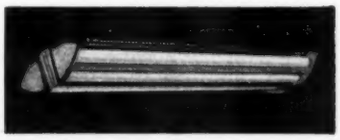
(Name on request)



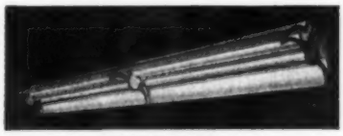
GUTH UTILITY FLU-O-FLECTORS for 2 40-watt, 3 40-watt, 4 40-watt, or 2 100-watt lamps stand up under hardest use—are easy to maintain.



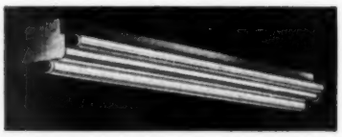
GUTH GLOW—constructed with elongated flutings to harmonize with the characteristic design of Fluorescent Lamps. Smartly attractive.



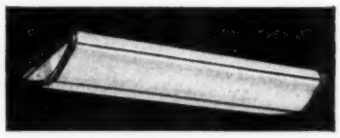
GUTH TRU-CO-LITE Direct-Indirect Luminaire for stores and offices. Fine styling—more light output—individual reflectors for each lamp.



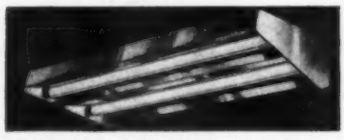
GUTH SURFACE TROFFERS for trim, modern appearance and excellent light distribution. Light cut-off with egg-crates arrangement.



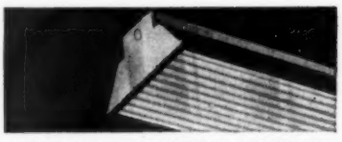
GUTH STRIPS for factory offices. Complete low cost lighting. Carried in stock for all lamp sizes. Easy to handle—easy to install.



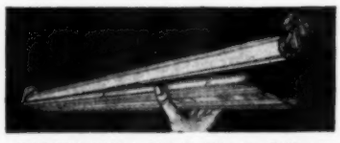
GUTH EXCELUX—Full-screen lamp diffusion with either glass or plastic shield. Ingenious hinged arrangement releases shield for access to lamps, etc.



GUTH SHOW WINDOW FLU-O-FLECTORS provide dynamic sales lighting with needed "punch." "Turn-around" reflectors for deep or narrow windows.



GUTH GLASS BOTTOM TROFFERS of engineered design permit ceiling mounting without severe "light and dark" areas on ceiling. Provides a cheerful light.



GUTH'S NEW PFC Plastic Diffuser combines efficiency with rare beauty. These PFC's shield unpleasant surface brightness without materially reducing lighting effectiveness.

ALZAK ALUMINUM REFLECTORS

Sell GUTH Fluorescent Fixtures with *Diffuse* ALZAK Aluminum Reflectors for better satisfied customers. Durable, easy to clean, more efficient.

AL ZAK, the Kid with the Extra Punch, Says:

Write today for GUTH Catalog No. 38—just off the press. It's full of money-making sales suggestions.

THE EDWIN F. GUTH COMPANY

2615 Washington Ave. • St. Louis, Mo.

Leaders in Lighting Since 1902

Guth

electrical contracting

With which is consolidated The Electragist and Electrical Record
Established 1901

Member A.B.C. - Member A.B.P.

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BY GEORGE, THEY DO WORK! The engineer at the South side mill wants me to give him an estimate on a complete re-wiring job using Anaconda Duracode.

WELL, MR. DOUBTING THOMAS IT'S ABOUT TIME. You said it was all luck when I got that $13,000 contract. But, now you know as well as I do that Anaconda's Survey and Guide helped.

You know, there's no reason why we can't get a lot more jobs. I remember reading where nine out of ten industrial plants in the country are losing money by putting up with inadequate wiring. And, what's more, estimates show that $300,000,000 will be spent for Electrical Modernization this year.

Why, we'd be crazy if we didn't try to grab our share of that money!

Without obligation send me a copy of Anaconda's new Wiring Survey.

*Company Name*_____

*Address*_____

*Title*_____

40331

ANACONDA
from mine to consumer

If you are unable to obtain copies of the Wiring Survey from your Anaconda Distributor, use this coupon!

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Anaconda Wire & Cable

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trical
contracting
APRIL, 1941

Once Was Enough!

CICERO, IN A LETTER TO ATTICUS, described a visit from Julius Caesar. Caesar, journeying to Rome, was invited to rest at Cicero's country place. He came, with two thousand—horse and foot soldiers, satellites and slaves. Describing his efforts to provide food and beds and to protect his property, Cicero wrote—*"He is not a guest to whom one would say—'Pray look me up again on your way back.'—Once is enough!"*

ONCE IS ENOUGH! What a war cry for the world today! But again, the German nation is out with death and terror, trying to rule other peoples, to deny other men their right to freedom. And again America is arming.

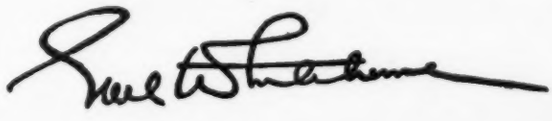
ONCE WAS ENOUGH—but here we are! Spending uncountable billions, we are supporting Britain's battle and preparing to defend ourselves. Our government, our armed forces, our leaders of industry are struggling to hold back this flood of blood and tears. But what of us electrical men?

MOST ELECTRICAL MEN HAVE NOT YET AWAKENED in this emergency, it seems to me. A few are hard at work in Washington. But it is not enough for power companies just to provide plenty of power, for electrical manufacturers just to fill all orders, for electrical contractors just to respond to every call for wiring. That is not near enough!

WE HAVE A BIGGER PART THAN THAT to play. For nothing really counts but the production of more and more guns, shells, tanks, planes, ships and supplies for fighting men. And we electrical men have not yet begun, earnestly to apply ourselves to increasing the production of America's factories. We have not seen this as our job.

WHAT SHOULD WE DO? We should set up in every city a "Committee on Defense Production." This committee should organize a "patriotic check up of defense production possibilities." This check up should report to the committee, to the Government and to the management of each factory, all possibilities for increasing capacity, speeding production, improving working conditions and cutting costs. Plant electrical staffs will welcome such aid. They know; but too often cannot sell their management on the expenditure.

REVEALING SURVEYS OF THIS KIND have already been made in some cities. Others are now in process and prove it can be done—and profitably. Until we do all this, we are only taking care of our own business. We are not really trying earnestly to help win the war. Yet our help is badly needed now. *Once was enough!*



REWARD FOR YOU...

helping Industry put an end to these losses...

LOST
LOST—by general manager, 7 minutes ... while trying to get in touch with the plant superintendent who was "somewhere around the building."
LOST—in shop, 6 man-hours work, waiting to get O. K. from the test laboratory.
STRAYED—one "key" man needed in a conference, while 4 other executives sit around twiddling their thumbs.
DISAPPEARED—one secretary, engaged in scurrying around looking for the Chief Engineer.
LOST—the good-will of an important customer, who was left hanging on the phone while the Sales Manager was being located.

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GRAYBAR Inter-communication specialists are ready to help you in planning installations to meet individual needs. Send coupon for details on this equipment.

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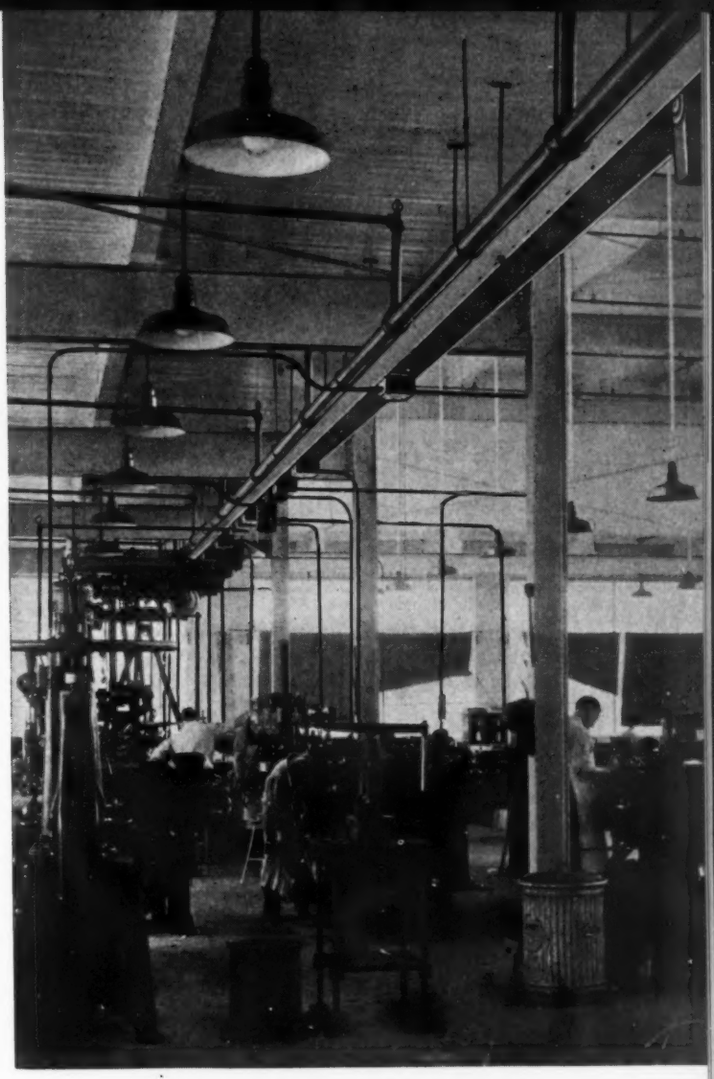
Graybar Everything Electrical GraybaR Electric Company

WIREWAYS and BUSWAYS For Distribution

How modern wireways and busways simplify electrical distribution and provide the adequacy, flexibility and salvability demanded by industry today. A review of applications and installation technique.

By August Eckel



FLEXIBLE DISTRIBUTION *in this machine shop is provided by enclosed bus bar distribution duct. Short conduit drops connect individual machines to the branch circuit plugs mounted on the duct.*

IN step with the rapidly increasing use of production line assembly have come new electrical distribution systems. They provide the accessibility, flexibility, adequacy and salvability demanded by mass production industries today.

We are speaking of what have come to be known as "wireways and busways," enclosed systems that provide frequent tap-off points along the length of the distribution run. And this means cable troughs and the various types of enclosed busbar systems that are manufactured as standard units, ready to install and use.

Of what do these systems consist? Where and why are they used? How are they installed? It is worth reviewing.

Generally speaking, the various types of busways operate on the same principle. Each consists of a number of busbars, depending on capacity and phase characteristics, mounted on insulating supports in a sheet steel or aluminum enclosure. Each type is made in a variety of current capacities and voltage systems, complete with the necessary mounting and circuit protection accessories. Each differs slightly in detail.

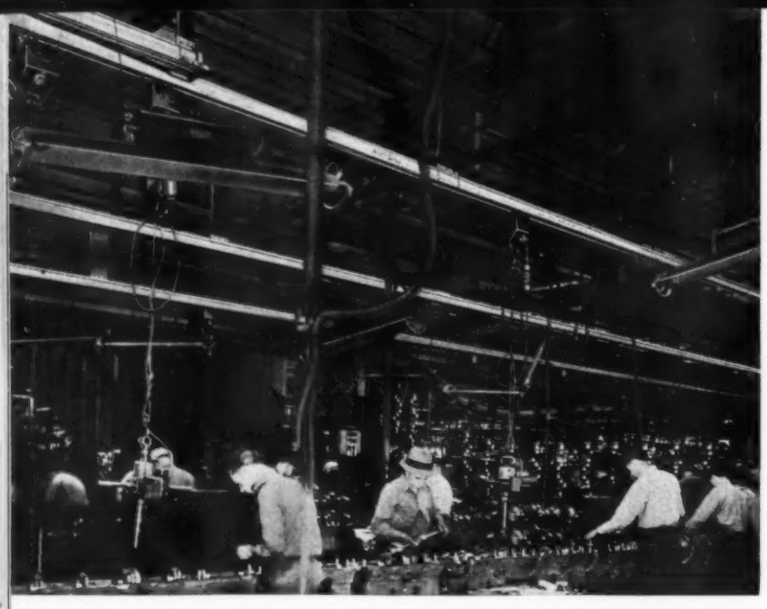
Feeder Duct

Construction—This busbar duct has different types of detailed construction. One make employs a U-shaped steel enclosure mounted to flanges on a flat back plate. Another make has two shallow U-shaped steel enclosures bolted together on center flanges. Others are essentially the same. This duct has no branch circuit tap-off outlets.

It is available in standard 10-ft. lengths, in capacities ranging from 250 to 7500 amperes inclusive; two or three-pole; 600 volts or less; three-phase, four-wire, 125/250 volt a.c. Up to 1000-ampere capacity, the feeder and distribution type of duct are the same. Both have outlets for branch circuit taps. Standard fittings include conduit feed-in boxes, crosses, tees, elbows, branch circuit adapters and fusible adapters for duct intersections.

Applications—This duct is used in both industrial and commercial buildings. In industrial applications, it is often employed outdoors to carry current from transformer secondaries, either from the plant substation or the utility connection on the building, to some central distribution point inside the building. Sometimes it is used as a vertical riser up the side of the structure, with feeder taps at each building floor. When used outdoors the duct is made watertight with gaskets and special paints.

For indoor applications, this type of duct is often employed as interconnecting feeders from transformer vaults or main switchboards to secondary subdistribution centers. It is mounted either vertically or horizontally, depending on the distribution system. In commercial buildings it is generally installed in a wire shaft in such a manner that sub-feeder taps can be made at each floor to serve power and lighting panels.



HIGH CYCLE TOOLS *for this motor assembly line are fed and supported by a trolley type enclosed bus bar system. Parallel lines of duct are mounted above each assembly line.*

TROLLEY MOUNTING *of portable metal buffing and grinding equipment in this plant is provided by the trolley type enclosed bus bar system. In this case the duct parallels a monorail system.*

Advantages—Busway feeders have these distinct advantages. They are briefly:

1. Flexibility through the numerous mounting methods.

2. Accessibility of all busbar connections through the handholes or the removal of the U-shaped steel enclosure.

3. Salvability approximately 100 percent. Any standard unit may be removed and re-installed elsewhere without material loss.

4. Adequacy for future load requirements through higher current carrying capacities.

5. Simplified distribution through elimination of parallel cable and conduit runs in heavy circuits.

6. High electrical efficiencies in short circuit stresses, current carrying capacities, reactance line losses and temperature rise. Maintenance costs low.

7. Equipment furnished assembled in standard lengths, ready for installation with the minimum labor. Bus connections are accessible for joining. Unit lengths are shipped carefully tagged, accompanied by dimensioned blueprints and instruction sheets. No cutting is necessary on the job.

8. Maximum safety. All busbars are totally enclosed, minimizing the danger of short circuits and protecting the plant personnel.

Installation Technique—This system is installed in the following steps:

1. The duct supports or hangers are mounted on predetermined spacings.

2. The duct and accessories are then laid on the floor with matching ends together, according to the manufacturers' blueprints and instructions.

3. Busbar joints, whether aluminum or copper, are cleaned on all contact surfaces with emery cloth, while the surfaces are covered with vaseline or a petroleum base material.

4. The first section of the duct is then mounted to the supports and the next section interfitted at the lap joints. The casing ends are then bolted together, making a compact and rigid assembly.

5. The overlapping busbars are then bolted together, through the access handholes. Covers are replaced and secured to the duct by small screws.

6. This procedure is repeated until the entire run is installed. Then the connections are made at the feed-in box, the service transformers or service entrance.

7. Before the current is turned on, the duct housing must be grounded, similar to conduit installations.

Distribution Duct

Construction—Distribution duct has essentially the same construction as the feeder duct. It also has branch circuit outlets at regular intervals along its entire length. In some cases they are on 10-inch centers on both sides of the duct; in others on 12-inch centers on one side of the duct only. These outlets are closed by pivoted covers on the inside of the duct casing and can be opened by turning the pivot screw.

In addition to the standard fittings listed under feeder duct, the distribution type has a series of branch circuit plug-in devices furnished in three different types; (1) the fused switch type which operates like an ordinary safety switch; (2) the swing-plug type, in which the contacts and in some cases the fuses are in the cover, which swings open to break the circuit; and (3) the circuit breaker type, which encloses a standard industrial circuit breaker with an external operating lever.

This type of duct is also available in standard ten-foot lengths, with capacities ranging from 125- to 1500-amperes inclusive; two- or three-pole; 600 volts or less; three-phase, four-wire, 125/250 volt a.c. The 1500-ampere duct is furnished for two or three poles only and is constructed with two steel duct halves separated by an aluminum channel.

Application—Distribution type busbar duct is used extensively in industrial plants where a high degree of adequacy and flexibility is desired. It normally distributes branch circuit current from the main feeder system to the machine location, the tap-off outlets being located directly above the machines.

This duct can be used in conjunction with the feeder duct mentioned above or with a conventional conduit and panelboard system. It can be fed either directly from the conduit feeder or from large circuits in a distribution panel.

Advantages—Supplementing those listed for the feeder duct, this distribution type has these additional features:

1. Additional flexibility in branch circuit outlets and plug-in devices, mounted anywhere along the duct run. Plugs are interchangeable in capacity and type, fused or circuit breaker. If a machine is moved it merely means disconnecting the plug-in device and reconnecting at the new machine location.

2. Additional adequacy through branch circuit outlets. It is a simple matter to add more circuits or change the capacity of present ones without disrupting production schedules.

3. Distribution simplified through elimination of conventional branch circuit panels and shortening of branch circuits runs to the machines.

4. Increased overall efficiency through the localization of circuit control in the immediate vicinity of the production machine.

Installation Technique—The installation of this duct is the same as that for the feeder type with the exception of these final additional steps:

1. The branch circuit plugs of proper capacity are wired on the ground, then mounted by screws or bolts to the duct housing at the opening nearest the machine to be connected. These plugs are polarized and fit the duct opening and contact the busbars in only one position.

2. Rigid, flexible conduit or heavy duty flexible cable extensions are then installed from the plug housing to the motor starter and all connections completed, including proper grounding.

Heavy Duty Trolley Duct

The trolley type duct is, in general, a mobile distribution system. It consists of busbars in a steel enclosure with a continuous opening along the bottom. Trolley type current collectors slide along the duct.

Construction—Heavy duty trolley duct consists of 100-ampere conductors enclosed in an insulated steel housing with channel shaped trolley rails on its sides or bottom. Branch circuit trolleys ride these rails and have collector wheels which contact the bars inside the enclosure. This duct is furnished in standard ten-foot lengths, either two- or three-pole, 110- to 600-volts. Special sections with a radius of three feet or greater are available as required. Standard take-off trolleys have a capacity of 30-amperes; heavy duty ones, 60-amperes.

Accessories include fusible or non-fusible trolley collectors, with or without tumbler switch, motor starting switch, lock type receptacle, tool hanger and cable support brackets; end boxes, feed-in boxes, slide-out sections for trolley insertion, and duct hangers.

Applications—This trolley duct is used extensively in industry for high cycle and universal portable tools for production lines; for supplying current to movable electric hoists and cranes; and for moving test lines. When supported with the standard hangers furnished with it, this system will support movable loads up to 200 pounds. With heavier hangers it can be used as a monorail system for loads up to 350 pounds.

Advantages—This system has all the advantages of the distribution duct plus the feature of providing a mobile outlet distribution. It makes possible the free movement of tools without cumbersome flexible cords, and a whole production line can be served with relatively few tools.

Installation Technique—Heavy duty trolley duct is installed in much the same manner as bus duct. The one exception is that the trolley collectors are inserted in the duct through specially designed slideout sections, which are replaced after the trolley is inserted. This can be done while the conductors are hot.

Light Duty Trolley Duct

Construction—Light duty trolley duct consists of two or three insulated busbars enclosed in sheet steel casing with a narrow continuous slot in the bottom giving access to the bars. One make has only two bars and is rated at 50-amperes, 250 volts for single phase service, but can be arranged for two- or three-phase service by using parallel ducts and a special trolley. A second make has three bars and is rated at 60-amperes, 250 volts single- or three-phase.

Accessories include trolleys, hangers, feed-in couplings, trolley-entrance couplings, end caps, twistout receptacles, trolley-mounted outlet boxes, fuse assemblies, sectionalizing assemblies and fixture and tool hangers.

Applications—This system is used extensively in industry and in some commercial applications for lighting distribution and light duty portable tool applications. It can be used in any non-hazardous location where it is desirable to bunch lighting outlets for special operations, then relocate on conventional spacings.

The advantages and installation technique follow that of heavy trolley duct. One make employs snap-in type, telescoping duct connections.

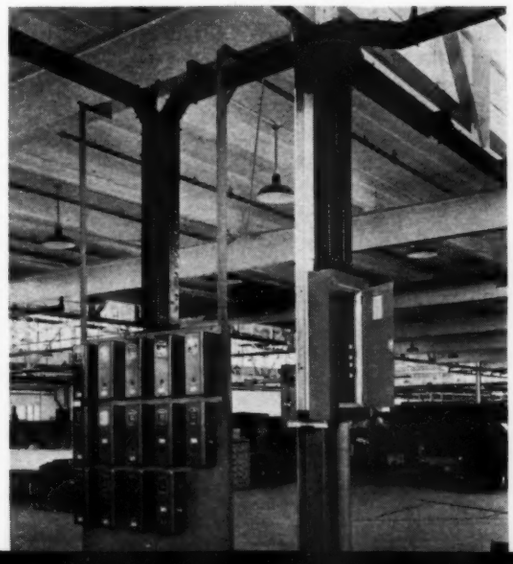
Cable Duct

Construction—This square steel duct, used for enclosing large numbers of cables, has conduit knockouts in continuous rows on three sides and a hinged cover on the top. It is available in standard one-, two-, and five-foot lengths

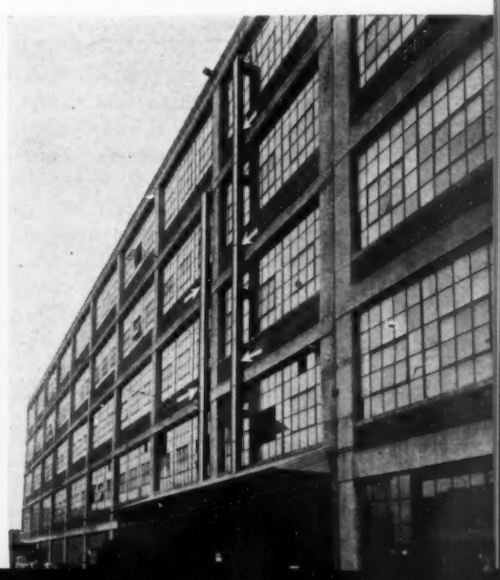
[Continued on Page 71]

MOBILE MOUNTING *for lighting units and portable tools is provided by trolley type distribution duct in this radio manufacturing plant. Trolley-mounted lights can be spaced to suit any lighting plan.*

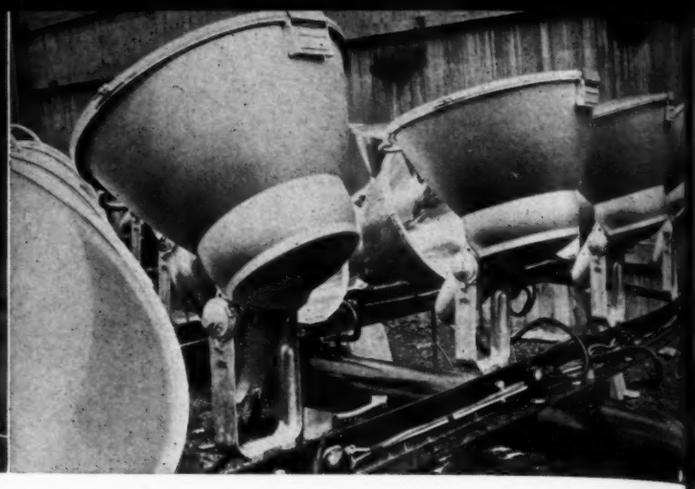
SQUARE STEEL DUCT *of 4-inch section houses the branch circuit cables for this bank of combination motor starters and other motor locations. Knockouts on three sides provide circuit tap-offs; hinged cover gives access.*



VERTICAL FEEDERS *of enclosed bus bar ducts carry current up the side of this factory building to feed each floor. Horizontal runs of the distribution type of duct complete the electrical system within the plant.*



NIGHT BASEBALL *at Mohawk Mills Park with all lamps individually adjusted to produce an even distribution of illumination with extra intensity in the diamond. The field seats 3000 spectators.*



CONNECTING *up the floodlights with the poles lying on the ground, with the cross arms resting on blocks. Seven conductor cables were used, with each wire identified.*

Some DATA on a Baseball Job

How a modern sports lighting installation was wired with the poles on the ground — With a list of the equipment required and a break down of the man-hours used.

By Perry R. Kimball
Langdon and Hughes Construction Company, Utica, New York

LAST season, the Mohawk Mills Athletic Association, in Amsterdam, New York, a member of the Canadian-American league, decided to install lighting so that the team could play night baseball. The various types and methods of making an installation were thoroughly investigated and it was finally decided to install 120 General Electric floodlights, of which 56 were to be the medium angle type and 64 the wide angle type. All of these floodlights were to be enclosed with front door glasses. They were to be mounted on eight Union Metal Company heavy duty, two section, steel poles, each 70-ft. high. The wiring was to be underground. On this basis plans were drawn, specifications were written and a contract for the complete installation was awarded to Langdon & Hughes Construction Co.

Immediately we placed orders on the various manufacturers for the equipment needed. The poles were delivered first. Each pole was received in two sections and was dropped off near its erection location. These locations are indicated as A, B and C on the sketch. The A locations were inside and the B and C locations were outside the fence. When delivered, the top section of the pole came complete, with the steel cross arm drilled by the manufacturer for mounting the floodlights. These top sections were mounted on blocks which made them handy for mounting the floodlights complete with door glass and lamp while the poles were still lying on the ground. Each of the A poles mounted 12 floodlights, the B poles 24 floodlights, and the C poles 12 floodlights. A weatherproof fuse box was mounted on each pole just below the cross arm.

With the floodlights and fuse boxes mounted on the poles, the assemblies were ready for wiring. This also was done while the assemblies were still mounted on blocks lying on the ground. A 7-wire cable was used in the wiring, a separate cable for each cross arm which mounted six floodlights. Each wire in the cable was marked so that it could be traced. The white wire served as the neutral and one side of each floodlight was fastened to it. Each of the other wires in the cable was wired to one of the floodlights.

In this way, it was possible to reduce the number of wires and still obtain the same effect. The cable entered the pole below each cross arm and extended down inside the pole to just below the fuse box. At that point, it was brought through the pole, the neutral wire was connected into the neutral of the system, and each of the other wires was connected to an individual fuse. By having a tracer on each wire, it is possible to identify each floodlight immediately with the fuse which is connected in its circuit and in case of fuse blowouts to replace the correct fuse.

After all the connections had been made the joints were soldered and taped. The wires were then bundled and tied together into a neat appearing job.

When the floodlights had been completely assembled and wired on the pole cross arms, the poles were ready to be erected on their bases. These had been constructed previously and consisted of a reinforced concrete block 3-ft. by 3-ft. by 10-ft. deep. The concrete had been poured some time before the arrival of the steel poles in order to allow plenty of time for curing. The anchor bolts for holding the pole in place were cast into the concrete base when it was poured. There were four of these per pole, each of them 2¼-in. in diameter and 5-ft. long. They were bent on the end to give them added strength in the concrete. Each of the bases at locations A1, A2, B2, C2, C3 and C4 were provided with two, 2½-in. long sweep bends for underground service. The bases at locations B1 and C1 were pro-

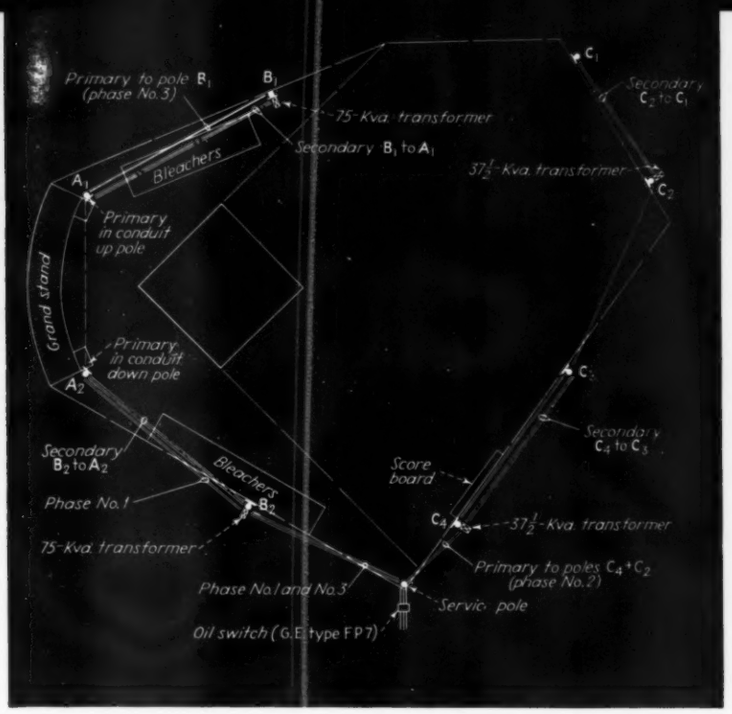


DIAGRAM *of Distribution and Pole Locations*

vided with only one 2½-in. long sweep bend. These bends were included in the bases to facilitate the underground wiring.

The erection of the poles was done as a subcontract by the Robert E. Foley Company of Binghamton, New York. They assembled the two sections of each pole on the ground and then with a 55-ft. gin pole swung them up into position. In erecting all eight of the poles, they did not lose a single floodlight. After the poles had been set in place they were bolted down firmly on the bases with the anchor rods. It was not necessary to guy these poles in any way.

At the time of assembling the poles on the ground the primary and secondary wires were run down the length of the pole. A hand hole was provided in the base of each pole through which it was possible to complete the wiring down through the long sweep bends.

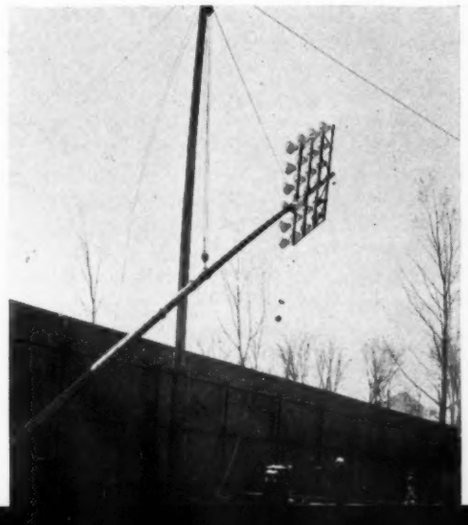
After the poles were erected in place, the final step in the installation, from a construction standpoint, was to run the distribution. The system carried a primary voltage of 4160/2400, a secondary of 240/120, three phase, four wire, grounded neutral. One 75 kva. transformer was mounted on pole B2 and also fed the floodlights on pole A2. Likewise one 75 kva. transformer was mounted on pole B1 and fed pole A1.

The outfield poles were provided with a 37½ kva. transformer on each of poles C4 and C2 and these poles fed the floodlights at locations C3 and C1 respectively. Each 75 kva. transformer was placed on a separate phase and the two 37½ kva. transformers were combined on the third phase to give a balanced load. A primary cutout and a lightning arrester were installed on the primary of each transformer.

[Continued on page 72]

CONCRETE BASES *showing anchor bolts ready for the steel poles, to say nothing of Olaf Olson, the job foreman (left) and R. J. Swackhammer, the General Electric floodlighting expert.*

HOISTING POLES, *with the two sections coupled, complete with lamps, mounted on cross arms and wired ready to hook up. Eight poles were raised this way without damage to the floodlights.*



MATERIAL AND EQUIPMENT

8 Union Metal hollow steel poles, complete with cross arms for mounting floodlights and transformers.
2 75 kva., 2400-120-240 v. transformers with two 5 per cent taps.
2 37½ kva., 2400-120-240 v. transformers with two 5 per cent taps.
4 Pellet type lightning arresters.
7 Primary cutouts.
1 200 amp., 5000 v. circuit breaker.
120 1500 w. floodlights with door glasses.
120 PS52 110 v. lamps.
6 12 ckt. weather proof fuse panels.
2 24 ckt. weather proof fuse panels.
16 2½-in. galvanized conduit elbows.
32 2½-in. conduit bushings.
120 ½-in. by 1½-in. galvanized machine bolts.
120 ½-in. by 2-in. galvanized machine bolts.
240 ½-in. galvanized lock washers.
120 Porcelain wire holders.
500 ft. Special 7 conductor cable, made up of six No. 12 solid wires and one No. 10 wire.
9 ¾-in. by 8-ft. ground rods.
2400 ft. 2 conductor No. 6 solid Aquanol insulated for 5000 v. concentric cable.
900 ft. 3 conductor No. 2 stranded 30 per cent rubber insulated for 600 v. 60 per cent tellurium jacket cable.
300 ft. No. 2/0 stranded DBRC Wire.
750 ft. No. 2 stranded DBRC Wire.
500 ft. No. 6 stranded DBRC Wire.
500 ft. No. 10 solid SBRC Wire.
Miscellaneous tape, solder, etc.
28 Cubic Yards ready mixed concrete.
4 Gals. green lead and oil paint.

BREAK DOWN OF LABOR

Excavating and placing concrete foundations for poles.
Foreman ..... 48 hours
Laborer ..... 192 hours

Unloading and trucking poles to site.
Pole truck and trailer ..... 16 hours
Foreman ..... 16 hours
Laborer ..... 32 hours

Assembling and raising poles.
Line truck and driver ..... 40 hours
Foreman ..... 40 hours
Lineman ..... 80 hours
Groundmen ..... 120 hours

Attaching cross arms and floodlights to poles on the ground.
Foreman ..... 20 hours
Wiremen ..... 60 hours

Wiring of floodlights and fuse cabinets on ground.
Foreman ..... 20 hours
Wireman ..... 60 hours

Excavation and back fill of trench for underground cable.
Foreman ..... 24 hours
Laborer ..... 160 hours

Installation of underground cable.
Foreman ..... 16 hours
Wireman ..... 8 hours

Setting Transformers.
Line truck and driver ..... 4 hours
Foreman ..... 4 hours
Lineman ..... 12 hours

Primary connections to transformers, lightning arresters and cutouts.
Foreman ..... 8 hours
Wireman ..... 16 hours

Mounting and connecting circuit breaker.
Foreman ..... 4 hours
Wireman ..... 8 hours

Secondary connections to transformers and fuse cabinets.
Foreman ..... 8 hours
Wireman ..... 24 hours

Grounding primary and secondary neutrals, lightning arresters, transformer cases and steel poles.
Foreman ..... 8 hours
Wireman ..... 16 hours

Adjusting and focusing floodlights at night.
Foreman ..... 8 hours
Wireman ..... 8 hours
Engineer ..... 8 hours

Painting poles and cross arms after erection.
Painter ..... 64 hours

INSIDE the F

What it consists of and how it operates. First in a series of three articles to help the electrical contractor in combining data and installation experience.

By S. G. Hibben

Director of Applied Lighting, Westinghouse Lamp Division, Bloomfield, N. J. who travels the country helping us all to understand the possibilities of the lighting art, the opportunities it offers.

THE current is turned on. A fluorescent lamp together with its starter switch and its controlling transformer or ballast unit has been connected in the circuit. Let's see what happens and why.

Inside the $\frac{7}{8}$-in. diameter metal cylinder constituting the starter is a small glass bulb. It contains a very carefully regulated pressure of either neon or helium gas and a curved bimetallic strip, which arches down to a contact point and nearly touches to complete a metallic circuit.

Glow Relay Switch

This is the glow relay switch. For the 15 and 20 watt mazda fluorescent lamps it may be designated as FS-2 on the metal cylinder; for 30 and 40 watt sizes, the FS-4. The 100 watt starter is marked FS-6, or with modifications FS-64, and is $1\frac{1}{8}$ inches in diameter. These starters are not interchangeable for lamps of other wattages. Other types of starters are available for special lamps and services.

Now at the instant of turning on the current, and in the case of the FS-2 starter, for instance, at a voltage somewhere in the neighborhood of 80, an arc is established across the metallic gap at the end of the bimetallic strip. So whatever current flows through this small arc also flows in turn through each of the double-coiled tungsten wire electrodes in each end of the fluorescent lamp itself. In a brief instant the heat of this arc causes the bimetallic strip to bend and make a metallic contact at its end. Thereupon, the arc ceases and its heating effect no longer exists, and the strip cools and straightens out. This, in turn, open-circuits the series connections through the lamp electrodes. In the meantime, however, which might be a period of three or four seconds, these electrodes have been passing about twice the normal operating current and have heated up to a yellow incandescence at about the temperature they should remain throughout the subsequent burning period of the lamp. This is the "hot cathode" type. Cold cathode types are tailor made tubes and not in general use for interiors.

Each electrode is a tungsten filament upon which a white oxide coating has been carefully baked. This produces a rich emission of electrons when heated. These invisible electrons fly down the bore of the lamp tube, like a continuous supply of minute machine-gun bullets. They may be regarded as current carriers, since when they exist they constitute a flow of current. They encourage the arc stream to be maintained between these electrodes. But if the necessary starting voltage were applied to the electrodes when cold, there would be a resistance to the establishment of the arc. The sudden shock would greatly depreciate and prematurely ruin the emission coating. Meanwhile, also part of the recurrent shock of the reversing current is taken by small metal wires or "annode guards" on each side of each electrode.

Ballast Coil

At the instant that the glow relay open-circuits, the reactance transformer or ballast coil contained in the elongated rectangular metal can, delivers a "reactance kick." It is a sort of pent up surge on the order of perhaps 500 volts, which insures the striking of the arc within the lamp and gives that first momentary flash of brightness throughout the tube. Now if the arc persists as it should, it will keep the electrodes at the proper temperature for the continuation of electron emission. It will pass current which is from then on limited by the automatic valve action of the ballast unit.

Every arc tends to run away with itself if unrestricted. This is because it tends to get hotter and, with lowered resistance, passes more and more current until the device would be destroyed. The chief function then of the ballast reactor is to hold down the current to a predetermined value. This is established by the design of the laminated iron and the turns of wire composing the ballast.

If for some reason the arc fails to continue within the fluorescent lamp, the glow relay switch repeats its starting efforts at a few seconds interval. So the visible evidence of a non-starter is a series of periodic flashes each time the glow relay open-circuits. In a normal lamp, however, this is the evidence of the end of life because the internal resistance of the lamp has gradually built up until the available line voltage is no longer sufficient to maintain the arc stream. Consequently a flashing lamp should be taken out

CHARACTERISTICS OF FLUORESCENT LAMPS

Lamp Watts	Bulb Size		Approx. Lumens	Approx. Life Hrs.	List Price*
6	9″x⅝″	Daylight	155	750	$1.00
		White	180		1.00
14	15″x1½″	Daylight	370	1500	1.05
		White	460		1.05
15	18″x1″	Daylight	495	2500	.85
		White	615		.85
		Soft White	435		.95
20	24″x1½″	Daylight	730	2500	1.10
		White	900		1.10
		Soft White	640		1.20
30	36″x1″	Daylight	1200	2500	1.10
		White	1450		1.10
		Soft White	1050		1.20
40	48″x1½	Daylight	1700	2500	1.60
		White	2100		1.60
		Soft White	1500		1.70
65	36″x2⅛″	Daylight	1800	2000	2.75
		White	2100		2.75
100	60″x2⅛″	Daylight	3350	2000	3.50
		White	4200		3.50

*As of March 1, 1941.

e Fluorescent Lamp

of the sockets as soon as possible. Otherwise the continuous functioning of the glow relay after a day or two, changes its characteristics, while also the excess current pulsations may overheat and even destroy the ballast unit.

The moment the normal arc is established and maintained, it parallels the glow relay in the circuit. But because the contacts in the glow relay have opened up, no further power should flow through it. Neither would the available voltage impressed across the contacts in the relay be sufficient to cause it again to break down and arc, unless and until the fluorescent lamp is turned off, and restarted.

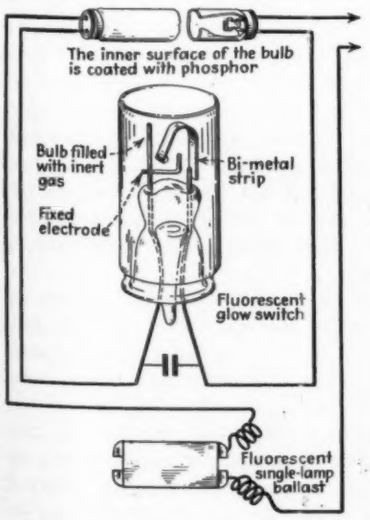
Fluorescent lamps of the 30 and 40 watt sizes, when used on 120 volt

TABLE I — Operation of Fluorescent Lamps

Lamp Size	Lamp Operating Volts	Lamp Operating Amps.
15W T-8.....	56	.30
15W T-12.....	49	.33
20W T-12.....	62	.35
30W T-8.....	103	.34
40W T-12.....	108	.41
65W T-17.....	50	1.35
100W T-17.....	72	1.45

range circuits, require in the neighborhood of 200 volts across the lamp and choke coil, hence the ballast also is a step-up voltage transformer. The ballasts for 120 volt range wiring have their design centered at 118 volts and should not be used on circuits lower than 110 nor higher than 125 volts.

BASIC CONNECTIONS FOR THE FLUORESCENT LAMP


The inner surface of the bulb is coated with phosphor
Bulb filled with inert gas
Bi-metal strip
Fixed electrode
Fluorescent glow switch
Fluorescent single-lamp ballast

In the high voltage range the design is centered at 236 volts and the units are operable over a range of 220 to 250 volts. Another style, at 208 volts, covers 199 to 216 volts. For the range of lamp voltages see Table I.

Basis of Color

Now assuming that an arc stream has been established within our fluorescent lamp, what occurs next? When the lamp is manufactured, the glass tube is coated with the fluorescing material or "phosphor". This has nothing to do with "phosphorus" but consists of mineral compounds as shown in Table II. Each phosphor is characterized by its ability to emit a chosen color of visible light.

TABLE II — Minerals that Produce Color

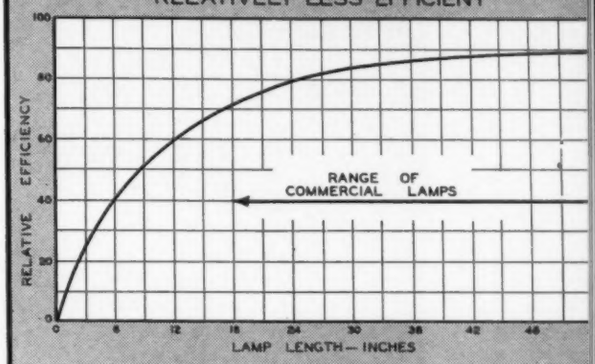
Phosphor	Color of Light
Magnesium Tungstate.....	Bluish White
Zinc Beryllium Silicate.....	Yellow White
Cadmium Borate.....	Pink
Calcium Tungstate.....	Blue
Zinc Silicate.....	Green
Double Coating.....	Red
Double Coating.....	Gold

When the ends of the coated tubing have had the electrodes sealed in, and it has been thoroughly exhausted, it is filled with a little pure argon gas and a few drops of mercury. During operation the tube, therefore, contains a mixture of argon and mercury vapor at a pressure of some 1/200 of atmospheric pressure. The argon helps carry the electron stream and permits the establishment of the arc when the lamp is cool at starting. But in a few moments the mercury vapor builds up and continues in a balanced state of very low pressure.

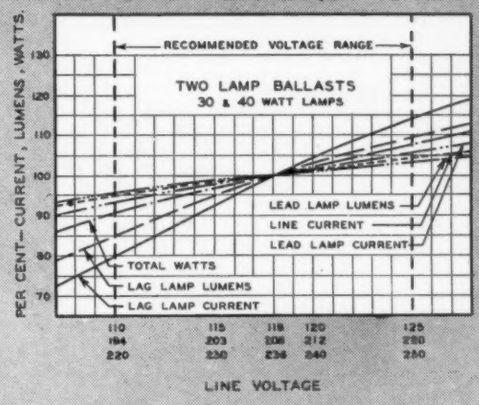
It is this mercury vapor which we say becomes "ionized" or excited in the arc stream and gives out the majority of its energy in the invisible ultra-violet radiation of about 2537 Angstrom wave-lengths. It also emits in weaker volume the mercury lines in the visible spectrum, mainly at 5460 and about 5800 Angstroms. Some of these may leak through the phosphor coating and are transmitted by the glass tubing itself. However, the 2537 Angstrom radiation cannot escape from the fluorescent lamp and is mostly

(*Continued on page* 84)

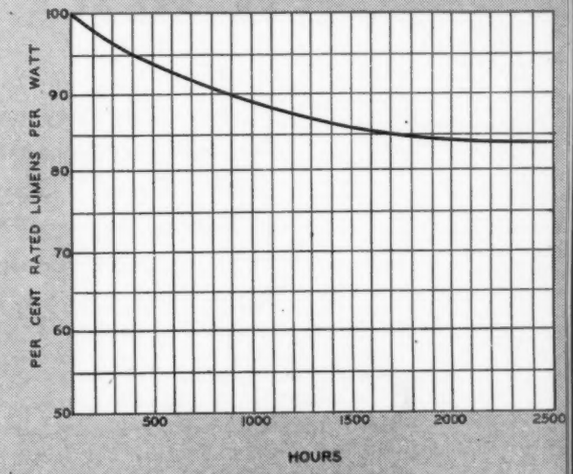
SHORTER FLUORESCENT LAMPS ARE RELATIVELY LESS EFFICIENT



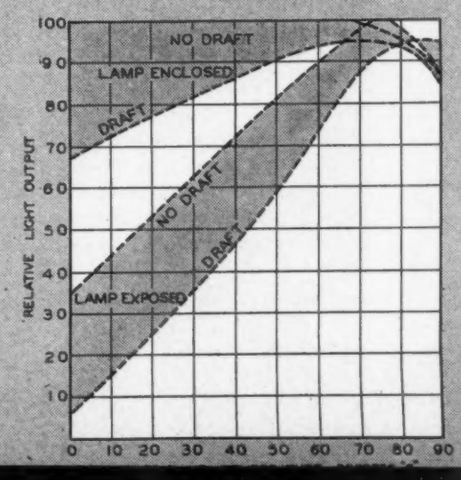
THE INFLUENCE OF VOLTAGE ON CONSUMPTION AND OUTPUT OF FLUORESCENT LAMPS

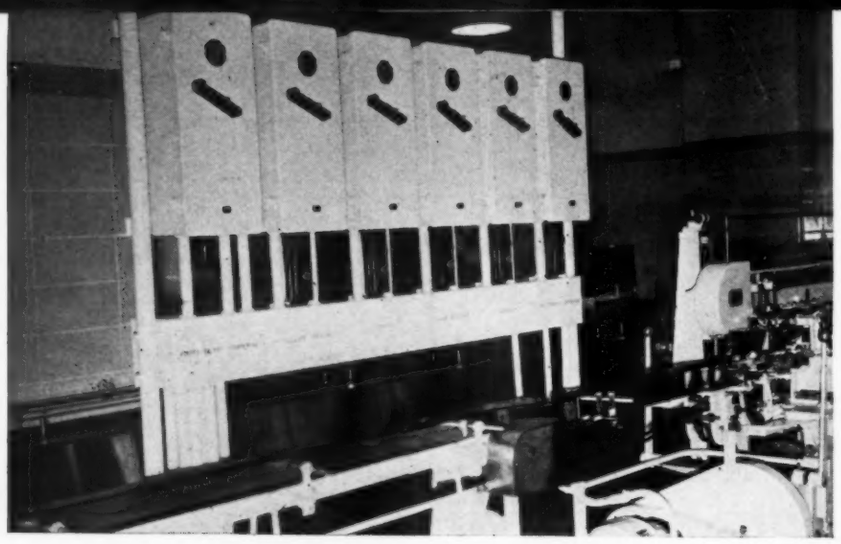


FLUORESCENT LAMP DEPRECIATION CURVE



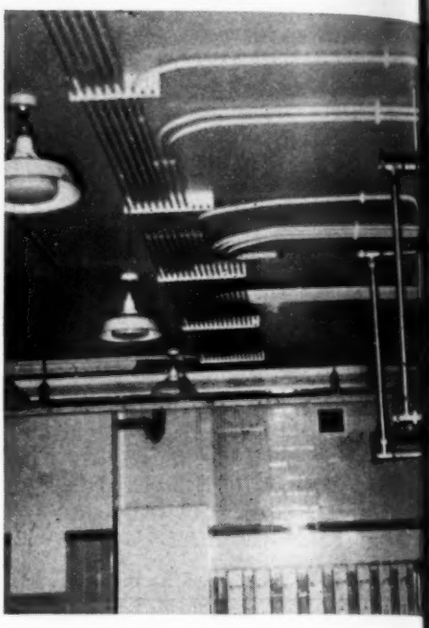
HOW TEMPERATURE AFFECTS LIGHT OUTPUT





COMPLEX GLASS *conveyor machines have a battery of controllers and a splice box mounted above. Mountings are arranged for easy cleaning and convenient alteration.*

MOTOR CIRCUITS *are racked on plate hangers at the ceiling and brought down to the motor terminals. Glasssteel diffusers are standard lighting.*



Wiring A CHEESE FACTORY

Modern machinery and production methods at the new headquarters building of the Kraft Phenix Cheese Corporation in Chicago, is backed by top quality wiring, centralized control, provision for future changes and many features of interest to electrical contractors.

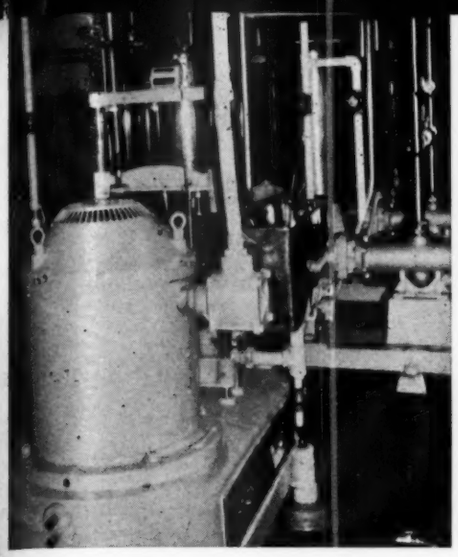
CHEESE making has been, for centuries, a delicate process, rightfully an art. To produce more than a hundred varieties of cheese, each perfectly uniform in structure and flavor, in quantities for world wide distribution, demands the integrated skill of a large organization, closely coordinated from laboratory to retail outlet. The Kraft Phenix Cheese Corporation is such an organization. Their headquarters in Chicago, housing general offices, research laboratories and a share of manufacturing operations, has an electrical installation typical of the accent on precision product control.

The electrical wiring system was designed by the engineering staff of the corporation, headed by G. Howard Kraft and was installed by Henry Newgard & Co., Chicago electrical contractors. Two 2,300 volt delta, three phase services are brought to the building transformer vaults and there converted to 440 volt, three phase, three wire for power distribution and 208/120 volt, three phase, four wire, for lighting and fractional horsepower motors. The 1,500 kw. demand is approximately 55 per cent power and 45 per cent lighting. Of the power load a large proportion is devoted to air conditioning and refrigeration of which three distinct systems are in use in the building, air conditioning for office space, cold processing in manufacturing areas and cooling the large 62,000 sq.ft. basement storage room.

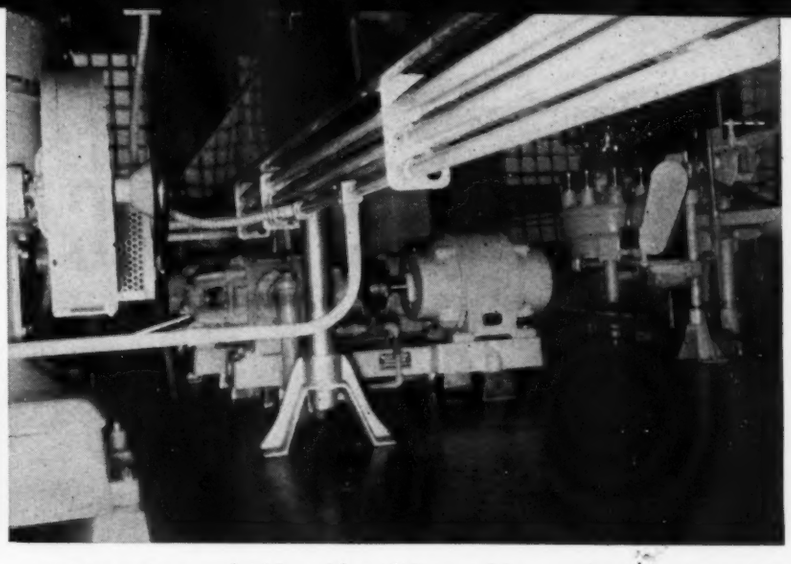
Every effort was made to provide one of the finest lighting systems for this type of structure in the country. An average of 18 foot-candles is claimed for the entire plant. Drafting rooms and offices involving close detail work are engineered for 28 foot-candles. General office space from 18 to 22 foot-candles, manufacturing areas from 12 to 16 foot-candles. The lighting for storage and warehouse spaces is designed for the particular task performed in these areas, cold storage spaces are provided with approximately one foot-candle and warehouse areas with 5 foot-candle lighting intensities.

Full indirect lighting units provide the light in offices, glasssteel diffusers and RLM dome in the manufacturing areas.

Office areas with air conditioning use a unique combination of air duct grills and lighting fixtures. Cylindrical ports for the air conditioning system extend down from a suspended, acoustically treated ceiling with the lighting unit suspended below on short stems, the entire assembly forming a pleasing decorative unit. The proximity of



FLEXIBLE CONNECTIONS *and water-tight junction boxes are provided on all motors.*



PRECISE, NEAT *control wiring with conduits spaced for easy cleaning and removal in steel plate hangers. The pump base raised from the floor to avoid dirt pockets.*

the air conditioning port to the lighting fixtures also removes the heat from these units before it has an opportunity to circulate through the room.

Feeders

Designed for flexibility and convenient alteration, the feeder systems are run from a switchboard pullbox suspended exposed on the basement ceiling to riser points adjacent to columns. The risers are carried through water-tight sleeves set in the floor and pick up distribution panels on each floor.

Feeder layout drawings were made in advance of construction and hanger inserts were cast in the slab. Special hangers consisting of ten gage steel plates drilled for each conduit run with edges turned to form a 90 deg. angle were suspended on threaded rods hung from the inserts. The careful design and layout paid dividends when the hangers were set, for with over 700 hanger supports set before the pour only two were lost and all fit exactly when the conduits were run.

Wiring

The wiring consists of galvanized conduit throughout with double duct fiber underfloor systems in portions of the sixth, seventh and eighth floors.

Feeders have code insulation and branch circuit 30 per cent grade covering. In all areas where wiring is exposed to dampness the new water resistant rubber insulated cables are used. Number 14 wire is the minimum size on push-button controls and motor branch circuits on the 440 volt circuit and number 12 is the minimum size used on the lighting circuit.

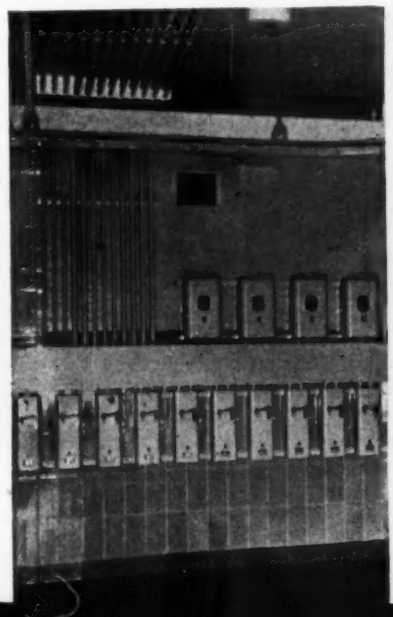
Motor branch circuits are carried exposed on the walls and ceilings in the same manner as the feeder system, using the same type of drilled plate hangers.

On a typical machine the motor controllers are mounted on a framework above the machine. A splice box below forms a convenient interconnection point for motor circuits and control circuits. The entire mounting is especially designed to provide easy access for cleaning and to avoid dust pockets. Control wiring is also especially arranged to permit utmost cleanliness and convenient alteration. Where a number of conduits are run on the machine they are supported on drilled plates which space the conduits and hold them away from the frame. Threadless couplings and connectors are used to permit easier removal.

The individual control circuits are carried back separately to this splice box. Thus alterations in individual controls or safety circuits can be made quickly and easily without disturbing the balance of the control wiring. The hanger plates and conduit terminals are deliberately arranged to allow any single run of conduit to be removed individually. Connector strips in the splice boxes facilitate interconnection and maintenance of the control circuit.

In the mayonnaise department, where a large group of portable machines are used, motor control switches are racked along a wiring gutter at the wall within sight of the machine. Each magnetic switch is provided with a disconnect switch. The motor circuits are then extended to heavy water-tight and acid-proof plug receptacles and push button stations. The portable machines are connected by heavy duty flexible rubber cord which includes a grounding connection. All motor fittings are water-tight and the majority of motors used in this installation are of splash-proof construction.

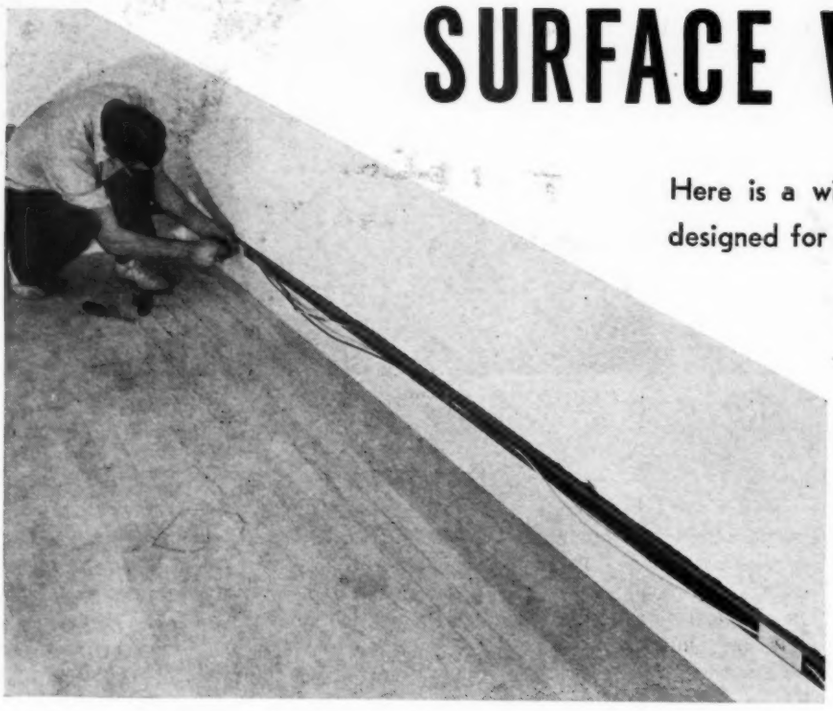
MACHINE PRECISION *on this battery of combination magnetic and disconnect switches circuits extend through the wiring gutter to the controllers and disconnects*



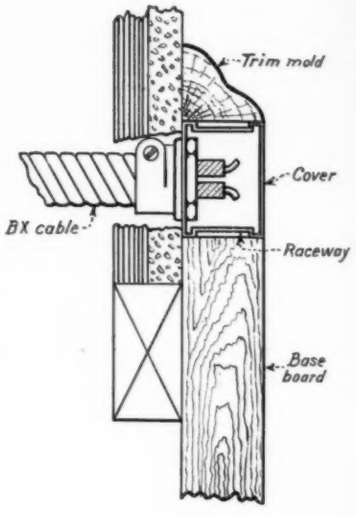
NEAT CONDUIT *racking under conveyor line routes complex control circuits and motor leads which serve this sequence of electrically interlocked machines*

SURFACE WIRING for

Here is a wiring system usually considered as designed for wiring extensions. But it should be studied by the electrical contractor and the architect for new work also, because it offers adequacy and installation advantages that are important.



INSTALLING RECEPTACLES *after the wiring channel has been mounted on top of the baseboard. Note slack in wires.*



MOUNTING DETAILS *showing the Plugmold mounted flush betweeen the baseboard and trim with feeder coming in back of channel.*

UP in a quiet suburb of Hartford, Conn., stand two homes, recently built by John and Robert Murphy, sons of Hayes Murphy, president of the Wiremold Company. These homes are unique and interesting because of the wiring system installed in each by Bauer & Co., electrical contractors of Hartford. The houses are modest, simple structures, built for comfort and convenience and they possess a facility for electrical convenience that defies inadequacy.

The wiring system is not spectacular or complicated. It is the simple multi-outlet surface raceway assembly called "Plugmold" and developed by the Wiremold Company. It was chosen by the owners, not merely because it is a product of their company, but because they wanted an electrical layout that would give them the convenience, adequacy and flexibility they need now—and will need in the future. Plugmold assembly consists, essentially, of a metal channel or raceway which is installed flush with and between the wood baseboard and its trim molding. The cover of the channel snaps off and the plug receptacles can be wired and snapped into the channel at any desired point. The intervening spaces are covered with blank snap-on cover plates. When painted, the raceway blends with the baseboard and becomes a concealed wiring system.

In these homes, this raceway encircles each room, forming a continuous wiring channel around the entire room. Where the wall space was cut up by doorways, concealed radiators, cabinets and fireplaces, the raceways were connected by BX jumpers installed concealed, behind or above the radiators and cabinets—whichever was easier. The jumpers were saddled underneath the doorways and over the mantles of the fireplaces.

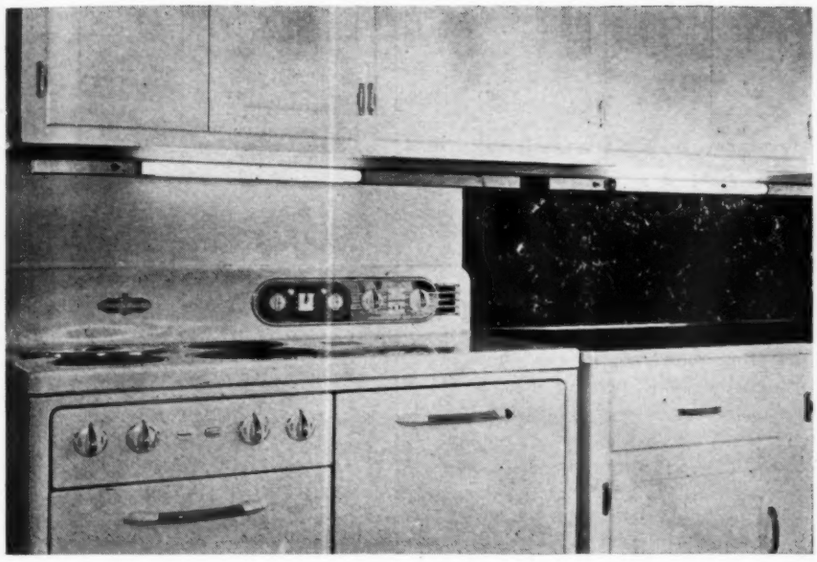
This method was used in living rooms, dining rooms, bedrooms and studies. In the kitchens, above the work areas and directly under the wall cabinets, a continuous row of Plugmold was installed with alternate receptacle and lumiline lamp outlets, with individual switches for each lamp. In one kitchen a length of raceway was installed, flush with the plaster, above the breakfast table. In the other, it was mounted along the three sides of the breakfast nook, between the top of the wainscoting and the finish molding.

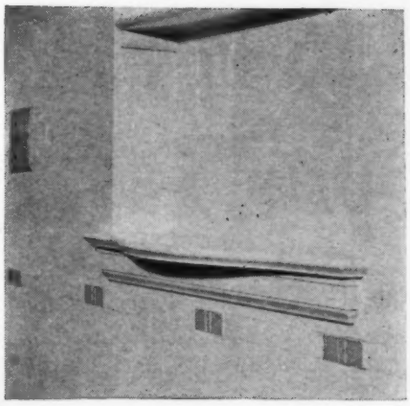
Flexible Circuiting

Two different sizes of the channel were used. In the living room the larger size, No. 2100, was installed because of its larger wire capacity. In this case, the extra capacity was needed to provide for three-way switch control of three of the receptacles, one on each of three sides of the room. Table and floor lamps connected to these outlets are controlled by the switches located at the foyer and porch entrances to the room. Two other circuits in the same raceway feed numerous receptacles which are available for plugging in the cleaner or fan or extra lamps. In the kitchens, this type was installed to provide capacity for the heavy duty heating appliances used.

The smaller No. 1900 Plugmold, used in the other rooms, has a capacity of only two No. 12 wires as compared to six No. 12 wires for the No. 2100. While receptacles may be placed as desired, they were in general spaced on four-foot centers around the room. The only exceptions were in the kitchens and on one wall of the master bedroom in one home, where three outlets were installed together between the twin beds for table lamps and a radio. In addition, one outlet was mounted on the

NEW HOMES





KITCHEN ADEQUACY *is provided (top) above breakfast table and (left) under the wall cabinets with receptacles and lumiline lamps.*

outer side of each bed for heating pads, sun lamps or any other appliance desired. In the living room of one home, a length of raceway was installed close to the wall and flush with the top of the mantle over the fireplace, for clocks and other devices.

With the exception of the kitchens, where there are three, one branch circuit feeds the continuous raceway in each room. Branch circuit connections to the raceway were made either from the back through knockouts provided for this purpose, or from the end through available fittings. On the smaller type, connections were made from the back through connector fittings. One home has a total of 81 convenience outlets and the other a total of 64. More may be added, of course, without disturbing floors or walls.

The installation technique was simple. The following practice embodying, in all, six steps was followed by the contractor. Some features are shown in the accompanying illustrations.

1. Each branch circuit was brought to a designated point in the wall during the roughing-in period.

2. After the walls were plastered and the baseboard mounted, the channel was mounted to the wooden runner, which is normally the nailing strip for the top of the baseboard and molding. The raceway is furnished in five- or ten-foot lengths with screw knockouts every eight inches. Branch circuit knockouts are also on eight-inch centers between the screw holes. The channel must be installed level and flush with the baseboard.

3. The receptacles were then wired at any desired distance apart, with sufficient slack left in the wires for easy positioning of the outlets.

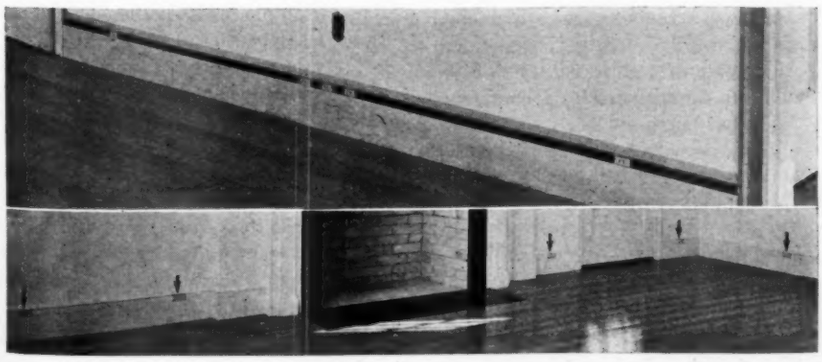
4. The wires were then laid into the channel and the receptacles snapped into place.

5. The cover plates were then cut to length and snapped on the channel. In the larger size the cover is scored every three inches, making it possible to add outlets by breaking out the required number of sections and replacing them with three-inch receptacles.

6. The trim molding was mounted on top of the channel and the entire baseboard, channel and molding painted.

Although this system has found its way into few new houses, to date, it is one method of effectively solving the problem of electrical inadequacy in the home. According to Contractor John Bauer, whatever increased initial cost there is over the usual outlet system, is offset by the convenience provided together with the comparatively small cost of adding future outlets. And who can measure convenience, flexibility and livability in terms of dollars and cents?

This system is new to the residential contractor and architect, but it is one which they cannot afford to ignore. For it provides what the home owner is seeking in electrical adequacy and convenience. With the proper organization of installation technique, there is no reason why the initial cost of this system cannot be reduced so it could be put into every new home built, regardless of size. With serious thought and application, this might easily become the conventional residential wiring system of the future.



(*Top*) GROUPED OUTLETS *on bedroom wall provide for two bed lamps and a radio between beds. Receptacles at extreme ends are for sun lamps or other appliances.*

(*Bottom*) ALL PAINTED *with the Plugmold painted to match the baseboard. Receptacles* (*arrows*) *are practically indiscernible.*

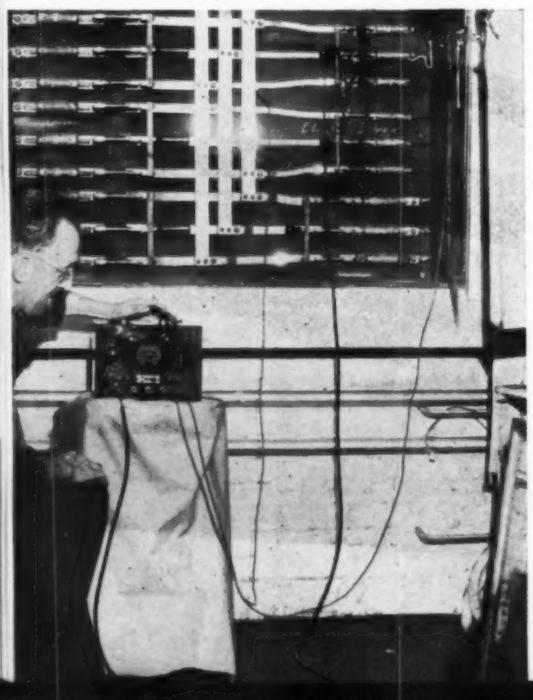
TESTING For "Safety Factor"

A testing technique and special instrument developed by a plant electrical engineer for making insulation tests on live a.c. circuits. A method of diagnosing the "health" of an electrical system and anticipating trouble.

By R. W. Smith
Plant Electrical Engineer
Julius Kayser & Company, Walton, N. Y.

A DOCTOR depends on his stethoscope to reveal the "wheezes and rattles" in a patient's chest. We depend on our patented "Safety Factor Meter" to show us, under operating conditions, the weak points where insulation breakdown might occur on our electrical system.

After years of experimenting to find something with which we could make live insulation tests on a.c. circuits, we developed this meter which functions as a component part of the system under test. It is as simple to operate as a voltmeter. The apparatus is designed to operate on 115 or 230 volts and uses alternating current from the circuits under test. Direct current is supplied to the instrument and test leads thru an electronic tube. When checking the "safety factor" of the system one lead is connected to the source of supply, the other to the grounded conduit or cable.



R. W. SMITH *checks the condition of his plant electrical system with the Safety Factor Meter. A reading of 2 megohms shows him that the system is in good condition.*

If a defective condition exists in the tested circuit, the direct current flows over the same copper as the a.c., through the weak spot to the grounded conduit and back through the instrument, causing the meter to register. Theoretically, if the system is in perfect condition the needle of the instrument, which has a double scale range from 25 ohms to 30 megohms, will not move. If a low reading is indicated during a test, it is easy to locate the defect. Instantaneous opening and closing of the panel circuit switches show in which department the defect is. Breaking down the department circuits will locate the circuit or piece of equipment that has the low reading. The defect is then corrected.

We have assumed a value of $\frac{1}{2}$ megohm on 230 volts and $\frac{1}{4}$ megohm on 115 volts as minimum and danger point values for these respective voltages. When a test indicates readings near or under these values, the system is immediately investigated and corrected. Readings above these danger points indicate how large a safety factor the system has and how soon trouble may be expected under normal conditions.

What is this "safety factor" and how do we determine it? Well, as we see it, "safety factor" is that value of ohmic resistance existing between the current carrying parts of an electrical system or equipment and grounded surfaces. It is directly proportional to the thickness and condition of the insulation and inversely proportional to its area. If this value is high, preventing appreciable current flow to ground, the safety factor is high.

In formula form, based on Ohm's Law for parallel resistances, Safety Factor looks like this:

For only two defects on a system—

$$\text{Safety Factor (in ohms)} = \frac{R_1 \times R_2}{R_1 + R_2}$$

More than two defects on a system—

$$\text{Safety Factor (in ohms)} = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4} + \frac{1}{R_5} + \text{etc.}}$$

Where:

R_1 = ohmic resistance to ground of defect No. 1.

R_2 = ohmic resistance to ground of defect No. 2.

R_3 = ohmic resistance to ground of defect No. 3, etc.

The above values of "R" are from readings of the Safety Factor Meter. The example shows the determination of safety factor from test data.

Our apparatus is arranged so it can also be used as a voltmeter with a range of 0–300 volts. A buzzer system is also provided for ringing out circuits or testing the continuity of low resistance paths. It is a handy instrument to use in conjunction with industrial analyzers and other instruments. This Safety Factor Meter is one more tool to help the electrical man keep an additional jump ahead of electrical trouble.

CALCULATING SAFETY FACTOR

PROBLEM: To make a Safety Factor test on a 220-volt, three-phase system consisting of a main feeder and a panel with three sub-feeder circuits. The main feeder and three circuits have one defect each.

TEST: Tested separately with the Safety Factor Meter, each defect gives the following readings—$R_1 = 700{,}000$ ohms; $R_2 = 3{,}500{,}000$ ohms; $R_3 = 8{,}000{,}000$ ohms; $R_4 = 10{,}000{,}000$ ohms.

CALCULATION: Substituting in the formula given—

$$\text{Resultant Safety Factor (in ohms)} = \frac{1}{\frac{1}{700{,}000} + \frac{1}{3{,}500{,}000} + \frac{1}{8{,}000{,}000} + \frac{1}{10{,}000{,}000}} = \frac{1}{.00000194} = 515{,}464 \text{ ohms}$$

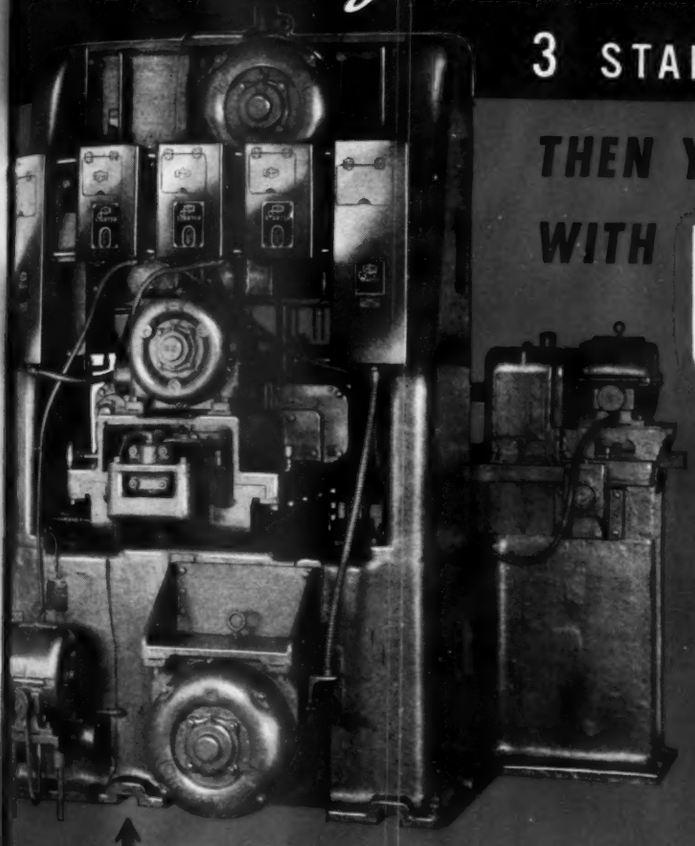
CONCLUSION: The resultant safety factor is too near the $\frac{1}{2}$ megohm minimum or danger point assumed for 220 volt systems. Each circuit should be checked and the safety factor increased.

RESULT: After checking each circuit the two lowest resistance values were increased to 9,000,000 ohms each. The resultant safety factor of the system is now 2,237,136 ohms or better than 4 times the minimum, giving a substantial assurance against insulation failure in the near future.

What do you need for your plant—

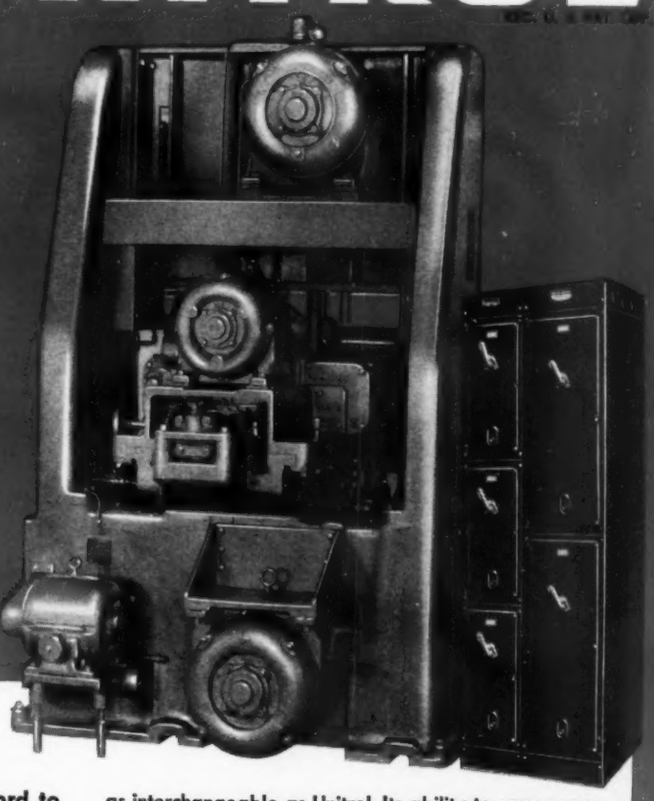
3 STARTERS OR 300 STARTERS?

THEN YOU ARE VITALLY CONCERNED WITH UNITROL



NOT THIS: It's a lot of work to hang needed controls on a machine . . . or to install them individually nearby. Bulky, inconvenient, space-wasting, costly to assemble and install.

BUT THIS: The same number of Controls takes up little space in a section or two of Unitrol nearby. And it's easy to construct, ship, install, and inspect control when it's built into Unitrol.



1st . . . . The Unitrol Unit

The basic element of Unitrol is a simple unit mounting-frame into which any standard control device may be bolted. This unit frame has integral with it a hinged cover or door which may be blank, or arranged for either dead-front manual or push-button operation of the device enclosed.

2nd . . . The Unitrol Section

is a steel enclosure which houses and supports a group of Unitrol Units. It is constructed of standardized interchangeable members to form the sides, top and back . . . with unique provisions for bus supports, wiring troughs, conduit or duct entrances, etc.

3rd . . . The Unitrol Control Center

consists of a grouping of Unitrol Sections fabricated into a complete sectionalized assembly and delivered ready for installation and use.

Unitrol is the next step forward in Motor Control Practice. But it offers so many advantages that you cannot afford to wait until you are ready to "modernize." Unitrol may have the answer to the problem that has "stopped" you *right now.*

You are invited to bear in mind conditions that face your plant right now, as you read about Unitrol. Unitrol is a new method of housing and installing conventional starters.

The first step is the new Unitrol single unit mounting frame, into which any one of several sizes of conventional starters or control elements can be mounted. The second step is the new Unitrol Sectional frame into which several *unit* controls in *their* frames can be installed. The whole section thus forms a completely enclosed, compact and accessible structure which can be located anywhere, near a machine, against a wall, in a corner and so on. The third step is the Unitrol Control Center composed of more than one section; it is as complete as you want it, extensible, flexible, actually custom-built to your specific and individual needs.

There is no other method of housing and mounting a number of starters as compactly as Unitrol. There is no other method of custom-building a complete motor control center to your individual needs as easily and economically as Unitrol. There is no method as flexible or as interchangeable as Unitrol. Its ability to save space is remarkable. It may eliminate a need in your plant to build plant extensions. It may prove to be just the type of control organization in your plant needed to break a "bottleneck." It grows in size or it contracts in size to keep abreast of your needs. The control elements housed in it may be changed at will, and easily. Its installation requires no special wall or floor preparation. Literally, it can be installed anywhere. Its cost is less than that of even an unsatisfactory substitute.

Unitrol's advantages are so great, its ability to save time, money and space as well as to solve building problems is so extensive that it requires a full-size 36-page booklet to tell them all. This booklet "Unitrol . . . the Next Step Forward in Motor Control" is sent free and without obligation to business executives. Dictate a memo to your secretary now—to send for a copy of this interesting book. CUTLER-HAMMER, Inc., *Pioneer Electrical Manufacturers,* 1306 St. Paul Ave., Milwaukee, Wisconsin.

CUTLER-HAMMER
UNITROL
C-H

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Earl Whitehorne, Editor

More Electrical Committee Votes

The NFPA Electrical Committee has considered the request of the National Electrical Contractors Association and the U. S. Conference of Mayors for a larger number of voting members. They say—"No." They believe that the committee is already too large and should not be increased in size.

But that hardly disposes of the matter. A major representation on this committee for an industry group is now seven voting members. But the electrical contractor, who handles the electrical construction of the country, and for whom these Code Rules are made has but two votes. It is not right. They are a major interest and entitled to a major representation. They should keep on fighting until they get it.

We grant that the Electrical Committee is already unwieldy in size. But does not that in itself suggest a simple sensible solution? Why not reduce the major representation of each major group to six voting members? Then give the electrical contractor four more and the status he should have because of his major function.

How Many Houses?

Census figures now show a total of 37,211,463 dwellings in the United States. Of these 34,772,673 are occupied. The number of domestic electric consumers in the country at the same time—on April 1, 1940—was 24,599,284. About 82 per cent of the occupied dwellings are wired.

If 10 per cent of these wired homes need re-wiring, in some part, that means two and a half million jobs. And this is most conservative. For anybody knows that at least a quarter of American houses have out grown their wiring. And then how many of the 2,438,790 unoccupied dwellings could be rented again if they were modernized electrically? Nobody knows that.

But everybody knows that there is an enormous market here needing mass selling and mass wiring. When do we start?

Better Tools Will Help

As good man power for electrical construction and motor repairs becomes scarcer in the present emergency, some smart employees are turning to a better use of tools—Why not? Much progress has been made in recent years in the development of tools that save time and effort. Certainly now is the time to take advantage of it.

Better pipe bending and pulling equipment and plenty of power tools speed the work on any wiring job. Coil making machines simplify motor repair work. It enables labor to accomplish more and soon pays for itself in actual savings. Better study your present tool equipment. See what you need.

Your Percentage

Last year made records in building construction. Contracts awarded totaled nearly four billion dollars, says *Engineering News-Record,* and a great part of that money will actually be spent this year. The wiring of these buildings is still to be done. And this year promises another bumper contract total.

Set down the figure for new buildings, whatever it should be for 1941. List under it another fabulous figure for the modernizing of factories and commercial buildings—all this work clearly in view and salable. Then list the possibilities for re-wiring in the homes of this country, if they are sold as they can and will be some day. And what do you get? Just totals so astronomical that they dazzle the mind.

But there is another angle on it. What percentage of the national population lies in your area? Well, by and large, that percentage of that total market is there also. That market is yours if you go after it.

Short Term Training

Manufacturers in America are feeling a labor shortage, which they expect to grow worse. They are meeting the situation with a new kind of apprentice training—short term training for specific jobs. There may be an idea in it for the electrical construction industry.

Our apprentice training has been neglected for more than ten years. The average age of wiremen today is older than ever before. And as work grows, with the electrifying of war-pressed factories, government defense projects, mass housing and general boom-time building, contractors are forced to use more men of lesser competence and dependability. It may be well to watch out for young men, who can be quickly schooled for special kinds of work and do it well, far sooner than a fully trained apprentice can be seasoned. Employers and unions should study the possibilities and prepare to act together.

This Run-Away Market

Demand for fluorescent lamps is growing at an amazing rate. From the start of 250,000 units sold in 1938, this year promises a demand for 15,000,000 or more. It is a run-away market and as such, full of trouble, because in haste so many mistakes are made.

It is only natural there should be plenty of people ready to exploit this

rich selling opportunity. The public, therefore, is being misled. And the electrical man should be doing more about it.

In every city, the power company, the contractors and the lighting manufacturers should unite in warning the buyer against changing his lighting without expert advice. And they should see that good advice is quickly available.

Ventilation? Why Not?

When a heating contractor gets a ventilating or air conditioning job, he has to call in a licensed electrical contractor to install the electrical connections. Why doesn't the electrical contractor get the whole job in the first place?

Not his field! Who says so? Your field is pretty much what you make it. And it is as easy for an electrical contractor to hire a tinsmith to do duct work as t'other way round. Incidentally, there is a lot of business and a lot more coming.

Busbars Also Resist

Habits in wiring design occasionally create blind spots that may bring about serious inadequacy. For instance, sub-feeders and branch circuit from a busbar distribution system may be carefully calculated for voltage loss, yet the busbar simply figured on the familiar 1000 amps. per sq. in. rule.

But if busbar systems extend any material distance, the voltage drop characteristics should be calculated like any other feeder. And if the load power factor is low, reactance becomes especially important.

The common practice of oversizing buses to allow for some future capacity usually prevents an immediate reckoning. But that added capacity may be used only at the cost of a considerable voltage loss.

To Check for Quality

In a mid-Atlantic city the architects are talking about jointly employing an inspector of quality. His job would be to check over the electrical materials that are installed on their jobs, to see that everything is as in the specifications. Too many times they find that some approved device of inferior grade has been substituted.

This should not be necessary, but apparently it is. The city inspector will pass safe materials. But when a man orders and pays for quality, we don't blame him for wanting to get it.

Back Talk

Re-Wiring Commercial Buildings

To the Editor—"Commenting on your editorial 'Another Dodo', the promotion of the new thin-wall insulation has been in the educational stage for the past two years. That is, we have been going through a 'cut and try' period in which personal contacts have sold the idea to local contractors, local inspection authorities and utilities have promoted selected installations.

"At our Annual Sales Conference last March we invited Mr. Hodill, then president of the Building Owners and Managers Association to speak on the possibilities of this new wiring development. We furnished speakers for meetings at Washington, D. C., New Jersey, Philadelphia and two or three other places for the Building Owners. In other words they were ready to take the ball and run with it.

"Our Wiring Committee has developed an interesting Kodachrome film on new wiring devices for commercial buildings. We have done much to 'sell this good idea' that does not appear in the headlines. We had a full-time man traveling around the country addressing meetings last year and are about to develop a national program on the modernization of commercial buildings. I agree with you that it is the power company's job. We admit it and we are getting lined up for an activity. And I think you will agree that when we get organized we usually go places."

C. E. Greenwood
Edison Electric Institute, New York

This is good news. For if an organized power company activity starts rolling in the important cities, the idea will soon become interesting to the building owners. When this program starts, the electrical contractors must be ready to tie in with vigorous action to support the local promotion. They can then survey buildings and make re-wiring propositions with good prospects of profitable business resulting. This is good news.

That "Three-Way" Switch

To the Editor—"I suggest calling three-way switches 'two-place switches' and calling four-way switches 'three-place switches.' This name suggests their use. When a switch is wanted just inside the back room to control a light in the back yard or in the garage and another switch in the garage to control the same light or lights, the name 'two-place switch' is quite explanatory and suggestive of their use.

"And when a rural user wants a switch just inside the kitchen to control a yard light, a garage light and a barn yard light, the name 'three-place switch' is quite explanatory and suggestive when the same light or lights may be controlled from a switch in the kitchen, garage and barn.

"Since in the above illustration there may be only one light or a group of lights, as in crossing large rooms, long hall ways or going up and down stairs, that may be controlled from more than one place, I think the name two- and three place switches quite appropriate, understandable and easily remembered."

E. E. Ayers
Ayers Electric Shop
Okmulgee, Oklahoma

Well, here's another suggestion—and it's better than the old name. Somebody asks "Who is going to decide what term will be used?" Why nobody. The right term will take hold and its use will spread. We still like the idea of just calling them "stairway switches."

This Re-Wiring

To the Editor—"I don't blame you for being impatient about this residential re-wiring problem. There is no question but that some day it will have to be tackled because more and more load is going onto the lines of the homes, with the old overloaded wiring system grunting and groaning. Like you, I am convinced from observation and experience that the job can never be done without a mass effort. I think it won't come until the utilities wake up and tackle it seriously.

In the middle of the depression an engineer here, who was out of a job, took a little kit and for several weeks made a living by going from house to house and selling the ladies additional wiring and repairs. He had never sold a thing before in his life and, mind you, he had to get spot cash from the ladies at home. He took out two electric irons one day. He sold them both that day for cash.

Now, if a lot of real salesmen were covering the town and working on a plan where the public could pay for the work on their monthly electric service bills I am convinced that a job could be done. And I think this is about the only way it ever will be done.

Keep up the good work and maybe something will come eventually."

G. W. Weston
Secretary-Manager
Electric Ass'n. of Kansas City

Right you are, Jerry. It is a matter of selling larger, a demonstration of the effects of voltage drop, an easy payment offer, a price based on a mass production wiring schedule. It can be done. It will be done some day. Why do we wait?

Small Diameter Wire

To the Editor—"Reading your editorial 'Another Dodo', I will cry with you on this matter of small diameter wire not for the same reason. You are shooting the wrong fellow. It is possible that our utility company, the Idaho Power Co., is different, but our experience is that the utility has been and is now doing a very fine promotion job, not only on small diameter wire but on all lines with which the contractor-dealer is concerned.

"I am personally inclined to place blame squarely where it belongs, on the contractor and on the manufacturer. We are selling the jobs, our customers are all informed on the possibilities and want action. About six weeks ago we placed an order for wire, from two manufacturers, in several sizes. The best delivery was six weeks, and to date all we have been able to obtain is some No. 12. It would seem about time that the manufacturers should arrange to have some stock.

"I am about fed up with bally-hoo, promotions, meetings and what have you, and then not be able to produce on the job. Witness fluorescent lighting. The contractor as a group is a dumb animal, but I take issue with your statement that 'the individual contractor would be a fool to try.' It is being done."

W. A. Hopper
Gem State Electric Co.
Boise, Idaho

You are fortunate, Mr. Hopper, that your power company has done such a good promotional job on the re-wiring of commercial buildings. So have a few others and more will gradually follow, but so far it has been pretty well neglected. Hence our outburst. And you are right that with the idea sold to building managers the contractor can try and successfully. But he cannot sell this idea individually unaided.

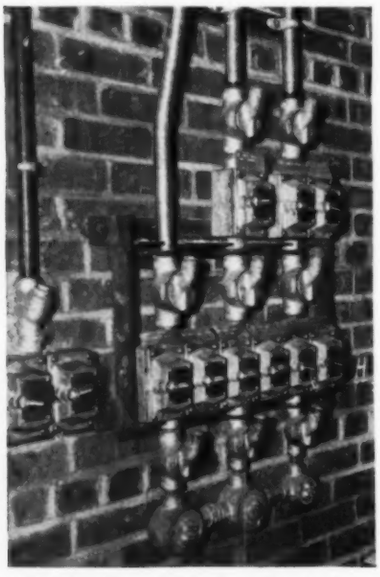
As to wire, we are going to see more and more of this trouble now with the Defense Program on. Deliveries will be slow and must be reckoned with.

WIRING Methods

EXPLOSION-PROOF METER PROTECTION

The use of the proper type of equipment in plants using hazardous materials is a long step to safe plant operation. So, M. W. Kellogg Company, oil refinery contractors and engineers of New York City, use explosion-proof enclosures on all control equipment mounted indoors in hazardous areas.

Here the circuit breakers, which protect and control the numerous instruments on the large control boards in an oil cracking plant, are mounted in explosion-proof enclosures. The breakers are arranged in gangs and supported by an angle iron frame mounted to the inside wall directly behind the control board. The conduit and fittings are held securely to the frame by U bolts. Sealing fittings are used wherever a conduit or nipple enters or leaves the breaker. Explosion-proof junction boxes are used where circuit tie-ins are made at the bottom of the units.



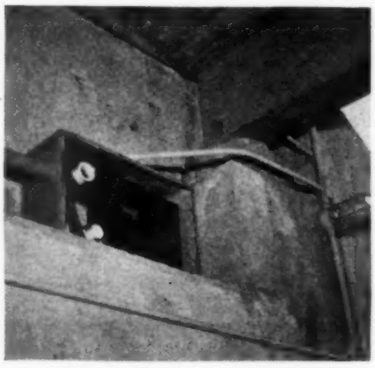
***MINIMUM HAZARD** is the result of using explosion-proof enclosures for the circuit breakers controlling the instruments on the large instrument control boards in this oil plant.*

Each circuit breaker protects the instrument to which it is connected and also serves as a disconnecting means when the instruments must be repaired or replaced. Individual circuit designations are stamped on metal plates which are mounted to the breakers by the cover mounting screws.

TAPPED THE STREET LIGHTING

To get light to places not provided for in the original plan and far removed from ordinary sources of energy the maintenance department of Golden Gate Bridge, San Francisco, used ingenuity. The street lighting circuits, available nearby, were tapped rather than make long runs to other sources of supply. A special transformer was built to transform the 6.6-amp., 440-watt, 2,300-volt supply to the sodium street lighting system down to 120 volts.

In one instance this supply was used to light a facility and toll building erected at the Marin end of the bridge. after the bridge was completed and also a pedestrian underpass in conjunction with it. It was used also to serve a bumper light of a flashing type installed at a division in the highway, as well as to light a neon directional sign.



***TRANSFORMER UNIT** under Golden Gate Bridge with locked pull boxes provide power tapped from street light circuit.*

The transformers were installed in heavy pull boxes, locked, under the bridge structure. Film cutouts similar to those used in the street lamp itself were employed to protect the transformers.

FLOATING TERMINAL

Air conditioning compressor equipment in the Mellie Esperson building in Houston, Tex. is mounted on a floating floor slab. Action of the springs may allow as much as ¾-inch motion with respect to the rest of the building.

The conduit terminals required flexibility to take up this motion and also to prevent transmission of vibration through the conduit. Flexible conduit in the size required was not available.

***FLOATING FLOOR** required a flexible conduit terminal on this large compressor installation. Conductors are 6,350,000 c.m. in parallel.*

The Alan Cooke Electric Co. installed extended pull boxes at the motor terminals. A separate end shield was installed free to move within the box. The conduit, connected to the shield, moves freely through the end hole. A bonding jumper grounds the shield and conduit to the junction box.

ADJUSTABLE MACHINE LIGHTS

Supplementary lighting is provided by adjustable machine lights in a large machine shop which was recently relocated in a New Jersey manufacturing plant. The units have an adjustable bracket arm which clamps to the conduit feeding the motor circuit for each machine and permits mounting the light in any position desired.

Boost Your TAPE Sales

WITH THESE TWO FAMOUS BRANDS

1. First to be Wrapped and **SEALED** in Cellophane
2. Perfect Adhesiveness and Tensile Strength
3. Strong Distinctive Green Core
4. Colorful Attractive Boxes
5. A Company in the Insulation Business Since 1878

Sold Exclusively Through Distributing Wholesalers

PANTHER and DRAGON Friction and Rubber Tapes

Why DOES HE WHITTLE AWAY ON

Ridiculous, isn't it? Clothespins aren't made by hand. Nor do they have a fancy assortment of heads. Standard designs and progressive manufacturing methods are the key to their low cost. The same principles apply to switchgear. With today's standard designs and efficient production-line methods you get modern, factory-assembled G-E metal-clad equipments at constantly lower costs.

SPECIALS? *To Standardize* IS TO ECONOMIZE!

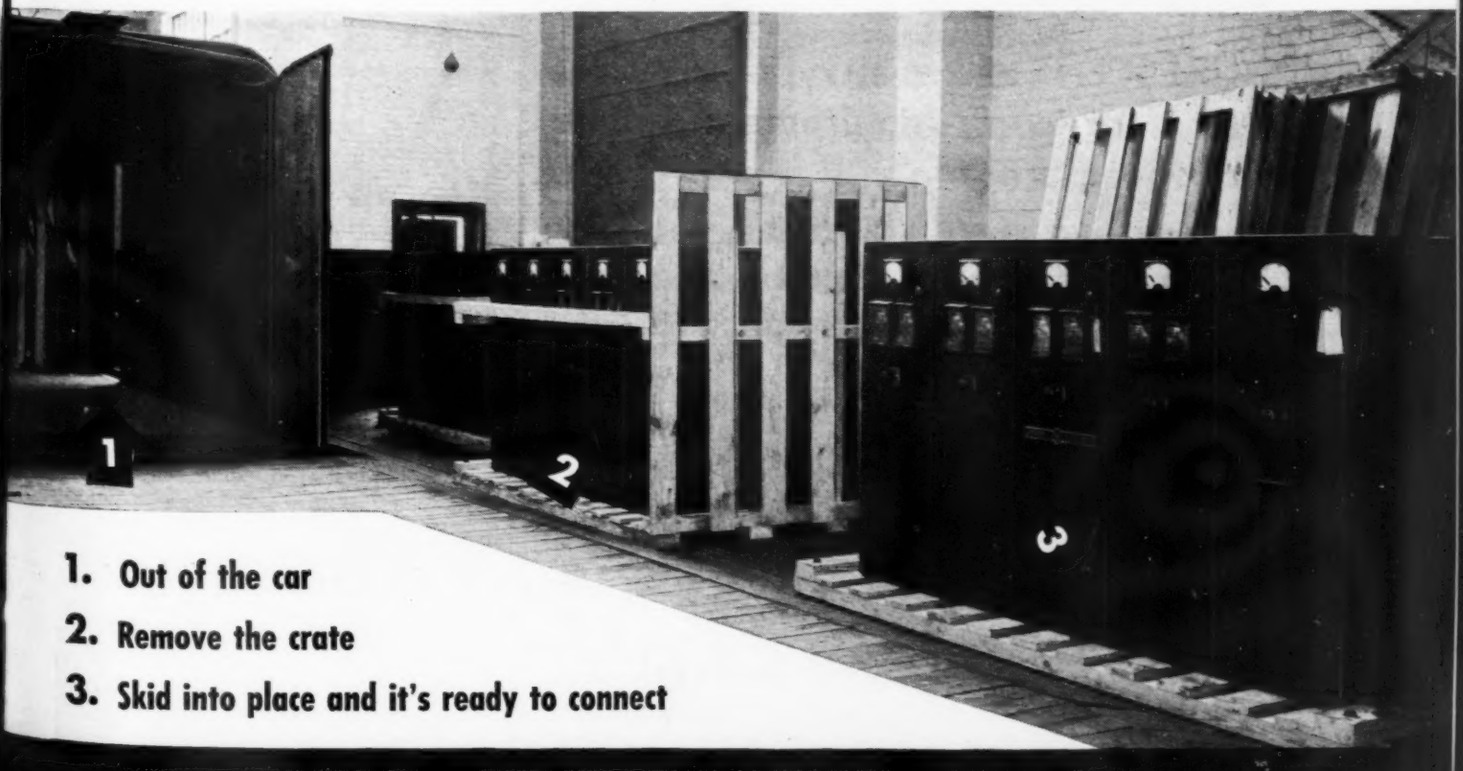
...and It's the Same with Switchgear

YOU avoid the expense and worry of fussing with design details and shopping around for a multitude of parts and devices when you install G-E vertical-lift, metal-clad switchgear. You gain all the advantages of standardization. G-E metal-clad gives you a completely factory-assembled, co-ordinated equipment.

Years of design improvement and extensive field experience have added materially to its flexibility of application for circuits up to 15,000 volts. This improvement, together with continuous progress in developing more efficient manufacturing methods, has made it possible for us to furnish standard G-E metal-clad units at progressively lower costs.

Your G-E representative will be glad to give you more facts and have a specialist assist you in studying the needs of your job. Call him today. General Electric Company, Schenectady, N. Y.

ALL YOUR POWER GOES THROUGH YOUR SWITCHGEAR



1. **Out of the car**
2. **Remove the crate**
3. **Skid into place and it's ready to connect**

GENERAL ELECTRIC

854-11

RUBBER COVERED POWER CABLES • BUILDING WIRE • ARMORED CABLE • FLEXIBLE CORDS • LEAD ENCASED AND PARKWAY CABLES • VARNISHED CAMBRIC • CRESFLEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE CABLE • MAGNET WIRE • BARE WIRE

CRESCENT WIRE

HELPS INDUSTRY EXPAND

CRESCENT ENDURITE CABLES for Light and Power Types RH and RHL Meet Federal Specifications JC-106-A, JC-121

CRESCENT makes all types of cables to meet every requirement. Some of these are:

- RUBBER POWER CABLES
- VARNISHED CAMBRIC CABLE
- BUILDING WIRE AND CABLE
- CONTROL CABLES
- PARKWAY CABLES
- PORTABLE CABLES

CRESCENT INSULATED WIRE & CABLE CO.

Ask Your Wholesaler for

CRESCENT WIRE and CABLE

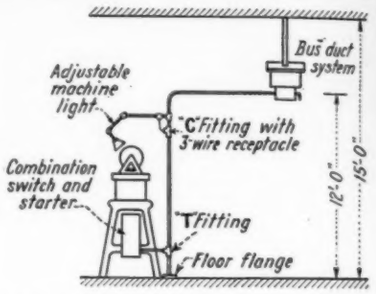
Factory: TRENTON, N. J.—*Stocks in Principal Cities*

CRESCENT ENDURITE SUPER - AGING INSULATION

WIRING Methods

[FROM PAGE 30]

Each lighting unit is fed by the conduit drop from the three phase, four-wire 120/208 volt bus duct feeder to the motor control switch. A "C" conduit fitting complete with a 3-wire grounded receptacle is inserted in the conduit drop and the light cord plugged into it. This method permits added flexibility in that the horizontal arm of the light unit can be raised or lowered as desired. Also, the light plug can be disconnected



CLAMP TYPE adjustable machine lights, fed through a receptacle in the conduit drop to the motor switch, provide supplementary lighting in this machine shop.

and a blower unit connected for blowing out the motor or for any other portable tool that might be necessary for repair work on the machine.

The motor circuit is fed from the same conduit drop through a "T" fitting with the circuit wires connected to the three phase wires of the system. A floor flange at the bottom of the machine drop provides rigid support to the conduit.

The electrical work involved in the relocation of the shop was done by the E. J. White Company, electrical contractors of Newark, N. J.

TROLLEY DUCT FEEDER

Bus duct of the three-phase, four-wire, plug-in type was used for power distribution and trolley duct for the lighting distribution, in an industrial plant electrical installation made by the Garden Electric Co., Inc., of Elizabeth, N. J.

The lighting system consisted of sixteen rows of 50-ampere two-wire trolley duct, mounted on messenger cable on 15-ft. centers and running the entire width of the building. Each row of the trolley duct was fed directly from the power duct through a 60-ampere fusible "swing plug" mounted on the power duct. Connection to the trolley duct was

A PRACTICAL NON-TAMPERABLE (Type S) FUSE

RESISTS TAMPERING AND OVER-FUSEING

WIPES OUT ANY EXCUSE FOR TAMPERING

A Fustat can't be replaced by a penny or slug — and it is practically impossible to bridge it with tinfoil, strands of lamp cord or any other material.

Stops use of over-size fuses — a 20 or 30 ampere Fustat will not fit in a 15 ampere receptacle or adapter. Similar limitations apply to all other sizes.

Once you have installed the correct size to protect, your protection cannot be taken from you.

But that's not enough . . .

A non-tamperable fuse that would blow on starting currents would be an impractical device — a terrible nuisance — so the Fustat . . .

because —

IT STOPS NEEDLESS BLOWING

A Fustat won't blow when washing machines, refrigerators or other motors start. A 15 ampere Fustat will permit you to load an ordinary circuit to capacity — and yet not blow on motor starting.

It gives you SAFE PROTECTION without USELESS SHUTDOWNS.

Adapter fits Edison base fuse holders and locks in place.
Retails at 7½c

Protects flexible cords against burnout — in spite of its long time-lag

The Fustat contains a fuse. The ability of a fuse to protect against dangerous cord shorts or grounded sockets is well known.

The Fustat – HOLDS like a LARGE FUSE when safety permits, yet, OPENS like a SMALL FUSE when safety demands

Today's circuits demand the Fustat —
for what other device can . . .

1. Make safe protection remain safe.
2. Stop loss of money on needless "blown fuse" service calls.
3. Permit adding more appliances to present circuits.

The FUSTAT

Retails at 7½¢ in 15 to 30 amp. sizes

For full information write to any of these firms

BUSSMANN MFG. CO., University at Jefferson, St. Louis, Mo.
JEFFERSON ELECTRIC COMPANY, Bellwood, Ill.
KIRKMAN ENGINEERING CORP., 121 Sixth Ave., New York City
NATIONAL ELECTRIC PRODUCTS CORP., Fulton Bldg., Pittsburgh, Pa.
UNION INSULATING CO., 27 Park Place, New York City

IT SAYS HERE IN THE BOOK

	Maximum number of conductors			
	No. 14	No. 12	No. 10	No. 8
3¼-inch octagon box	5	5	4	–
4-inch octagon box	8	7	6	5
4-inch square box	11	9	7	5

But if I use two clamps, I must *deduct* two conductors. If I use a fixture stud, I must *deduct* another conductor!

HERE'S THE ANSWER!

The J-K line of boxes—that's it! The clamps being on the outside of the box, will permit the use of *two more conductors* than the conventional internal-clamp-type box. No space is wasted inside the J-K box. The external clamp renders a *smaller* J-K box as efficient as a *larger* conventional box with internal clamps.

For Both Metallic and Non-Metallic Cables

The J-K box is equally suitable for, and can be used interchangeably with either metallic or non-metallic cable—or both types in the same box if desired.

RACO • ALL-STEEL developed and pioneered the J-K box. Over a period of years, it has gained an ever increasing *national acceptance.* Although many attempts have been made to equal its efficiency, no other box can serve the same wide range of utility as the genuine J-K box!

Write today for the catalog—containing all the facts about the J-K box and many other nationally famous RACO • ALL-STEEL electrical products.

Distributed Nationally by

ALL-STEEL-EQUIP COMPANY, INCORPORATED
604 Griffith Avenue, Aurora, Illinois
Factories: South Bend, Indiana; Aurora, Illinois

4-inch Octagon

4-inch Square

3¼-inch Octagon

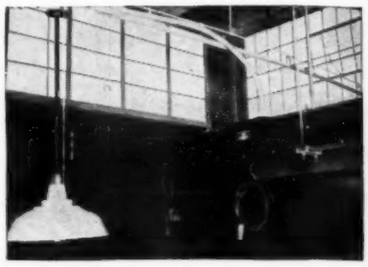
and Appropriate Assemblies of J-K Boxes on Bar Hangers

RACO • ALL-STEEL • PRODUCTS
Switch Boxes • Outlet Boxes • Cutout Boxes • Cabinets • Conduit Fittings
Distributors in All Important Centers

WIRING Methods

[FROM PAGE 34]

made through a length of 1-inch flexible conduit terminating in a rectangular outlet box on the duct feed-in coupling. At the power duct end connection is made directly to the swing-plug. Two



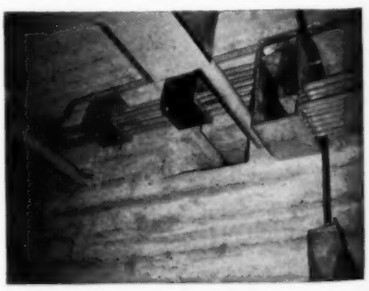
***FEEDER CONNECTION** from three-phase, four-wire power duct to trolley duct is through flexible conduit suspended from trolley messenger cable.*

No. 6 rubber conductors, connected to one phase leg and the neutral of the three-phase four-wire system, feed each row of trolley duct. The flexible conduit is suspended from the messenger wire by special hangers.

ISOLATING BARRIERS IN OFFSET PULLBOX

In wiring for control circuits in the new addition to the Municipal power plant at Moorhead, Minn., the Wood-Dudrey Electric Company installed several junction and pull boxes with horizontal barriers to separate the a.c. and d.c. circuits.

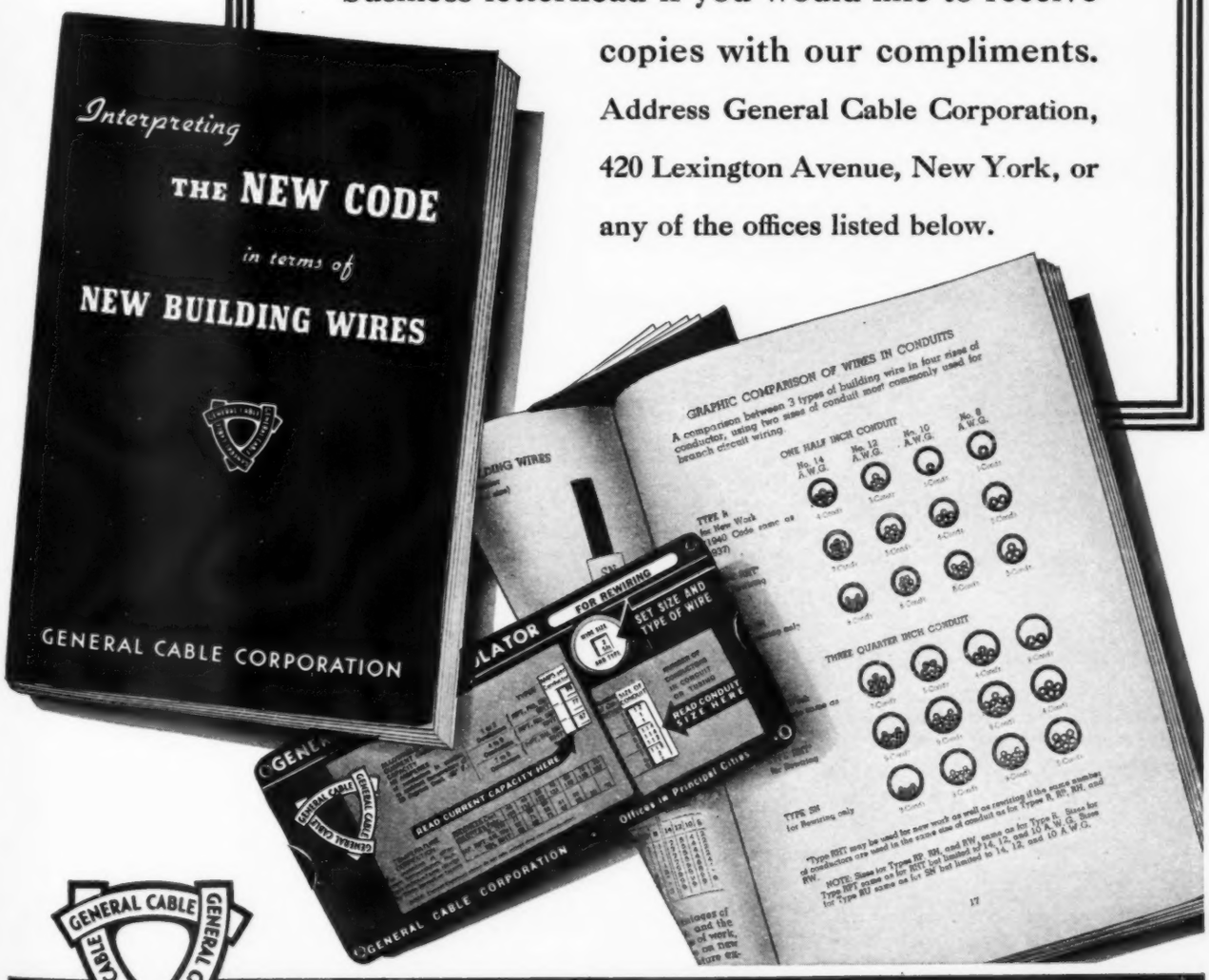
At one point, the conduit runs had to be offset 14 inches to clear main feeder



***BARRIER DIVIDES** pull box into two L sections for isolating systems at an offset in the run.*

conduits and still maintain the same relation between the runs. A pull box was designed with a Z shaped barrier. Direct current wires were run through the inverted L shaped section, a.c. circuits through the upright L shaped section formed by the barrier.

To facilitate interpretation of the NEW CODE, the handy Building Wire Calculator and Manual illustrated here have been designed by General Cable for contractors' use. Write us on your business letterhead if you would like to receive copies with our compliments. Address General Cable Corporation, 420 Lexington Avenue, New York, or any of the offices listed below.



GENERAL CABLE

BARE and INSULATED WIRES and CABLES for EVERY ELECTRICAL PURPOSE

Stocked by Electrical Wholesalers Everywhere

General Cable Corporation Sales Offices: ATLANTA · BOSTON · BUFFALO · CHICAGO · CINCINNATI · CLEVELAND · DALLAS · DETROIT · HOUSTON KANSAS CITY (MO.) · LOS ANGELES · NEW YORK · PHILADELPHIA · PITTSBURGH · ROME (N.Y.) · ST. LOUIS · SAN FRANCISCO · SEATTLE · WASHINGTON (D.C.)

Better Lighting

FIFTY-THREE FOOT-CANDLES AT SPENCER LENS

The Spencer Lens Company of Buffalo, owned by the American Optical Company, have installed a combination mercury and filament lamp system which produces 53 foot-candles initially.

The building is 410 feet long and 210 feet wide. The lighting consists

***MERCURY - FILAMENT** combination lighting units produce an average initial intensity of 53 foot-candles in this plant.*

of 198 Ivanhoe reflectors in the main area, each equipped with a 400-watt Type H lamp and three 150-watt lamps. These are spaced on 20 by 15 foot centers and mounted 15 feet high.

In addition, underneath the mezzanine, which is not shown in the picture, and in the mezzanine itself, there are a total of 63-500-watt, 28-200-watt, 61-150-watt and 77-100-watt RLM reflectors.

The complete installation was made by the Robertson Electrical Construction Corporation of Buffalo.

SHOE STORE USES COMBINATION LIGHTING

Downlighting and indirect lighting have been utilized by the Chandler Shoe Store, San Francisco, to create a pleasant shopping environment. The 3.4 watts per square foot provided throughout the 3600 square feet results in an average level of illumination of 25 foot-candles. The 10 indirect units in the foreground are equipped with 500-watt inside frosted lamps and those in the background with 300-watt silvered bowl lamps. There are 18 flush mounted Holophane plates, each equipped with a 300-watt lamp.

EXTERIOR LIGHTING FOR A BEAUTY SALON

The art of beautifying the women of our country ranks well up in the list of large scale business enterprises. This field is a highly competitive one and operators are constantly on the alert for anything that will make their places preferred above their competitors.

One way to win attention is through luminous architecture, as evidenced by this illustration of the Adelia Salon,

***LUMINOUS SIGN** adds to the appeal of this beauty salon window lighting. It helps attract pedestrian traffic and results in bigger appointment lists.*

Cincinnati. The sign is 2 feet high and 14 feet long and employs twenty-eight 50-watt lamps spaced on 12-inch centers behind diffusing glass.

This shop is located in a semi-residential district. The operator reports an increase in business since the installation, which she attributes to the feminine appeal of the exterior. The interior was also redecorated and relighted.

LIGHTING A BANK

The National Bank and Trust Company of Grand Rapids, Michigan has utilized fluorescent lighting to create for their clients a comfortable seeing environment.

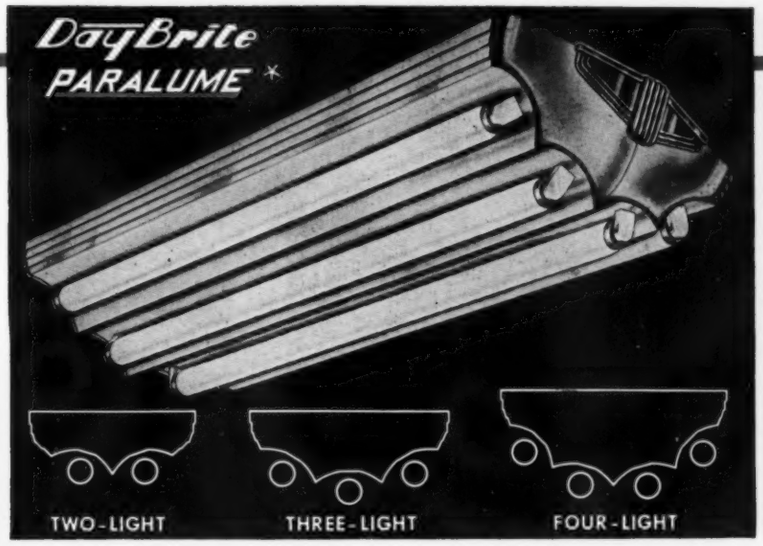
There are 7000 watts of fluorescent lighting, consisting of 126—40-watt

***COMBINATION LIGHTING** with indirect units and direct downlighting provides 3.4 watts per sq. ft. and an illumination intensity of 25 foot-candles in this San Francisco shoe store.*

DayBrite FLUORESCENT

T. M. Reg. U. S. Pat. Off

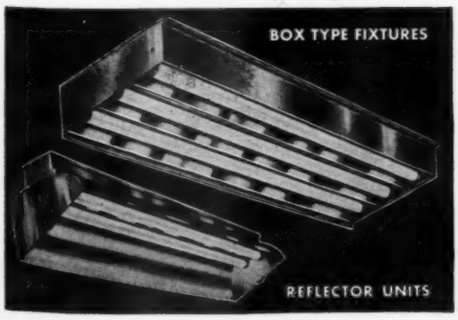
steps up your sales, your profits, your prestige



"PARALUME" is the ideal lighting fixture for all commercial applications—for stores, offices, restaurants, theatres, office buildings. Available for two, three or four fluorescent lamps.

Enclosed type units for commercial applications.

Two outstanding fixtures for industrial applications.



For Show Window lighting. Gives added sales punch through correctly engineered lighting.

In countless cities and towns throughout America, Electrical Contractors are rapidly dividing themselves into two widely-separated groups.

One group, grabbing for whatever fluorescent business it can get today, is hoping to find new prospects to provide for tomorrow.

The other, by selling only well-known, top-quality, correctly-engineered lighting equipment, is building a steadily increasing volume of profitable repeat business on the solid foundation of well-pleased customers.

Contractors in this second group are in an enviable position. They are always prepared to deliver the exact fluorescent lighting unit that meets a particular lighting problem. In Day-Brite, they have "The Complete Line of Fluorescent Lighting Fixtures"... built by an organization known the country over for top-quality lighting fixtures . . . with wide experience in all phases of fluorescent lighting . . . with extensive knowledge of commercial and industrial lighting.

Since your sales, your profits and your prestige all increase when you sell only well-known, top-quality, correctly engineered lighting equipment, your best business bet is Day-Brite. Because, by making satisfied customers and building repeat business, Day-Brite assures you of big dividends in the long run.

Write for Complete Fluorescent Catalog

DayBrite LIGHTING, INC.

T. M. Reg. U. S. Pat. Off.

5436 Bulwer Avenue St. Louis, Mo.

*T. M. Reg. U. S. Pat. Off.

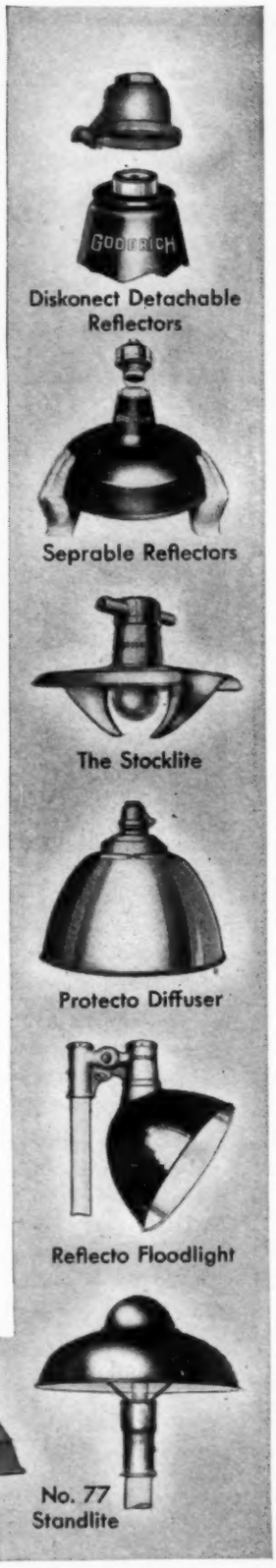
I like to install these GOODRICH FIXTURES

"In the first place, their patented fittings and mechanical features make Goodrich fixtures easier to install. They go together right—work right—stay right. That simplifies maintenance, too!

"Whatever kind of job I have in industrial illumination, Goodrich has the proper fixture to answer it. The line's complete . . . it includes all R. L. M.-approved fixtures as well as many styles for special purposes—fixtures I can't get anywhere else. And they all conform with recognized standards.

"When I run into a tough problem, Goodrich illuminating engineers are quick with the help I need. And I find that once Goodrich fixtures are on the job, I've made another satisfied customer. I guess that's why more and more concerns are specifying Goodrich. The word must be going 'round!"

Literature is available on all Goodrich fixtures.



Diskonect Detachable Reflectors

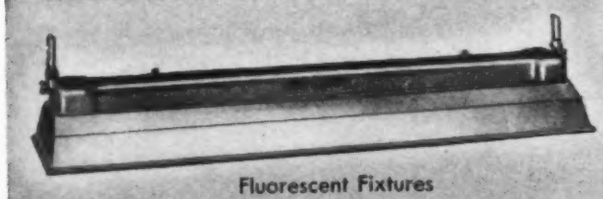
Seprable Reflectors

The Stocklite

Protecto Diffuser

Reflecto Floodlight

No. 77 Standlite



Fluorescent Fixtures

SOLD ONLY THROUGH ELECTRICAL WHOLESALERS

GOODRICH ELECTRIC COMPANY

OFFICES IN ALL PRINCIPAL CITIES

GENERAL OFFICES AND FACTORY: 4602 BELLE PLAINE AVENUE, CHICAGO, ILL.

Better Lighting

[FROM PAGE 38]

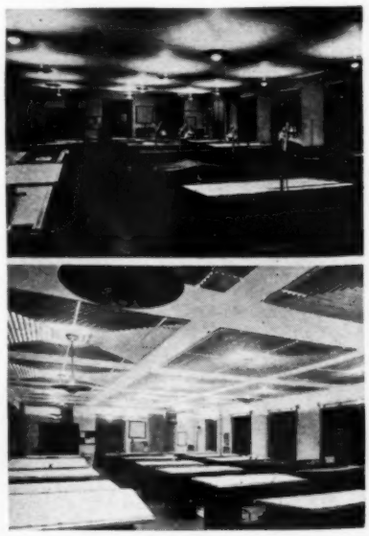
SEVEN THOUSAND watts of fluorescent lighting provides 3 watts per sq. ft. with 40 foot-candles in the work area and 75 in the entrance of this Grand Rapids bank.

lamps, 28—30-watt, 41—20-watt, and 20—15-watt. This results in approximately three watts per square foot.

The foot-candles vary with the different locations. The entrance area has 75, and the work area 40 foot-candles.

LIGHT-CONTROLLING CEILING

A comparatively new development, which might be placed in the same general classification as the coffer, is the especially-designed ceiling, here illustrated, which controls the direction of the light reflected from it. The primary purpose of this unique ceiling with its matte aluminum finish is to minimize the reflection of light rays out at angles near the horizontal and to increase the percentage redirected into angles between 0 and 60 degrees.



COMPARISON of lighting intensities without (top) and with (bottom) aluminum reflecting ceiling.

BUILDERS AND OWNERS, TOO, RECOGNIZE THE ADVANTAGES I GIVE THEM WITH "CENTRAL"

"It's gratifying to know in advance that **Central Conduit** written into my bid will meet with recognition and acceptance as a top standard of quality suitable to the most exacting requirements. It's gratifying, too, to know that we can put in a **Central** raceway System at an assured profit because it costs no more yet cuts, threads, bends and installs so easily that we'll save a lot of costly trouble and save plenty of man-hours.

"I like to advertise all my jobs as being protected with "Central" Conduit—because every one is trouble-free and they include many of the most imposing buildings and most demanding conduit applications of today. Central Conduit is doing a real job both from the standpoint of service and of working-advantages for us."

If you want to assure the success of your next job, specify and use Central Conduit. It's available from Spang Chalfant distributors in all principal cities.

For Sale By

SPANG CHALFANT, INCORPORATED

GENERAL OFFICES: GRANT BUILDING, PITTSBURGH, PENNSYLVANIA

District Offices and Sales Representatives in Principal Cities

SPECIFY

CENTRAL CONDUIT

"There's Tested Strength in Every Length"

● LIGHT plays a leading role in the crucial job of building for American defense. We are proud that MITCHELL Fluorescent Lighting has been specified for many of the largest defense program plants now under construction.

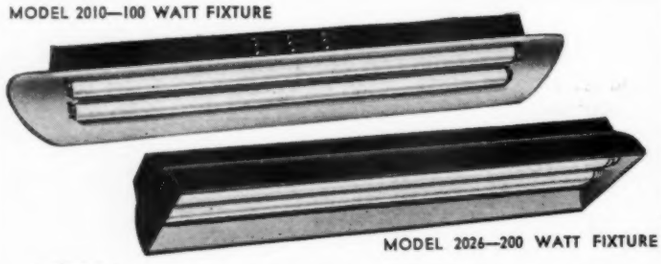
These same superbly-built MITCHELL Fixtures, singled out for their performing excellence after exhaustive comparative tests, are available to the industrial and commercial light users of America.

It pays to do business on a QUALITY basis with MITCHELL—the *complete* line that's making the biggest reputation in the Fluorescent field! Specify MITCHELL—the carefully engineered, ruggedly-built line with the Triple-Label Guarantee* — the line that's setting the pace for quality, smart styling and full Fluorescent value!

Specify MITCHELL — and be safe!

(MITCHELL Fluorescent Fixtures—specified by leading contractors—are sold only through Franchised MITCHELL Lighting Division Distributors.)

MODEL 2010—100 WATT FIXTURE



MODEL 2026—200 WATT FIXTURE

* MITCHELL Fluorescent Fixtures are Fleur-o-lier Approved. They meet more than 50 rigid specifications covering mechanical, electrical safety and lighting requirements. They're Underwriters' Approved, too—and for triple-measure—they bear the MITCHELL Shield of Assurance—your Guarantee of Quality . . .

MITCHELL MANUFACTURING CO.
2525 N. CLYBOURN AVE., CHICAGO, ILL.
"A Great Name in Lighting"

[FROM PAGE 40]

Any type of conventional indirect equipment may be used as the light source. The advantage of such a ceiling is that it appears much less bright when viewed from a distance than does the ordinary flat white ceiling, a factor which contributes much to the "optical coolness" of a 40 to 50 foot-candle installation. The efficiency of a system in large areas such as illustrated is about the same as for a flat white ceiling. In small areas, however, it may run from 20 to 25 per cent more efficient than a flat white ceiling as less light is wasted on walls.

SOME SLANTS ON WINDOW LIGHTING

By W. J. EBY
General Electric Company
Nela Park Engineering Department

Experience has shown that the show window display is an advertising device. The principal function is to attract the attention of and encourage *immediate action* by people who are:

1. *Fast-moving,* requiring three seconds, or less to pass by the average show window,
2. Subject to *countless distractions,* mental and external,
3. Tending always to *look straight ahead,*
4. *Sensitive* to *brightness* and *motion* at the side of the eye.

The effectiveness of the show window display in attracting attention and in leaving an impression is determined to a considerable extent by the amount of:

1. *Brightness*—Large areas of brightly-lighted merchandise and backgrounds make the whole display stand out from its surroundings. A high level of illumination on the merchandise makes it easy to see and appraise.
2. *Contrast* — Accent lighting, or highlighting, with clear and tinted spots makes it possible to direct the potential customer's eyes towards specific high-profit articles in the display.
3. *Color*—Fluorescent lamps make it possible, because of their high color efficiency, to obtain "dramatic" effects, thereby increasing the attractiveness of the display, without sacrificing the advantages of high brightness.
4. *Motion*—This never fails to attract attention. The action to be effective must be faster than the speed of the average passerby.

That good window lighting actually increases sales in a store, has recently

Here's your line-up for more money in Fluorescent!

This tells about the most exciting *profit* opportunity in Fluorescent today . . . the opportunity in Hygrade Fluorescent Lamps!

There's always a BEST!

In developing these lamps, Hygrade developed the finest methods, standards and materials. Finest workmanship . . . careful quality controls . . . painstaking checks and inspections on each lamp.

These things have made Hygrade first — *kept* Hygrade first in Fluorescent lamps.

Easier sales — less grief

And Hygrade *tells* America these facts — in aggressive national advertising that means sales and profits for you.

But—back of that—Hygrade superior lamp quality and performance means *solid* business for you . . . *less headaches . . . more profit!*

When you sell and install Hygrade Fluorescent lamps — or complete fixtures (Miralumes)—you give people most for their money: *minimum replacements . . . maximum efficiency . . . superior coating* (which turns ultra-violet into visible light) *. . . standardized colors . . . tops in performance!*

Nearly 100 patents protect Hygrade products!

Extraordinary lighting efficiencies are obtained in Hygrade Fluorescent Lamps by tuning the ultra-violet energy to the 2537 Angstrom Units wave length effective in causing the porous film (Hygrade Patent No. 2,096,693) to generate light as shown in Hygrade-controlled Patent No. 2,126,787. Hygrade products are exclusively protected by a large number of other patents, including No. 2,201,817 and No. 1,982,821.

FREE BOOKLET!

Write today for your copy of our helpful booklet — "How To Judge the Performance of Fluorescent Lamps." Dep't. EC4, Hygrade Sylvania Corp., Salem, Mass.

Hygrade Fluorescent Lamps

Hygrade Sylvania Corp., Est. 1901. Also makers of Hygrade Miralumes and Incandescent Lamps and Sylvania Radio Tubes.

Paragon
TIME SWITCHES are "TOPS"

for PROFIT

Paragon Time Switch
Series 300

IF IT'S PROFIT you want . . . trouble-free profit . . . install Paragon Time Switches Series 300. Here's what they offer: (1) are easy to install and set, (2) require an absolute minimum of service, (3) are guaranteed to operate properly in temperatures as low as 20° below zero, (4) positively not affected by dust, (5) highest type of design and construction, (6) 2,000% greater dial power than required to operate the switch.

ONLY $13.00 LIST

Liberal discount. Approved by Underwriters. Sold by Electrical Supply and Sign Supply Jobbers. Send for a bulletin.

The one and only time switch with just two gears in the open.

PARAGON ELECTRIC CO.
Builders of
Control Instruments since 1905
401 S. DEARBORN ST., CHICAGO

Better Lighting

[FROM PAGE 42]

been proved by these tests made in Ohio. The following data tells the story.

Test 1—Shoe Store, Ashland, O.
Additional cost per month for improved lighting..... $11.15
Additional number of people looking and stopping..... 12,000
Cost per impression..... 1/10¢

Test 2—Men's Furnishings, Ashtabula, O.
Additional cost per month for improved lighting $15.60
Additional number of people looking and stopping..... 4,400
Cost per impression..... 1/3¢

Test 3—Hardware, Ashtabula, O.
Additional cost per month for improved lighting $13.00
Additional number of people looking and stopping..... 4,800
Cost per impression..... 1/4¢

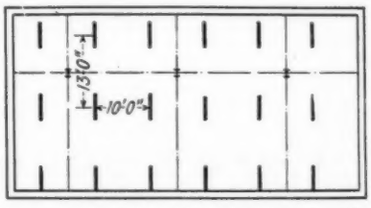
Lighting a MACHINE SHOP *Fluorescent*

PROBLEM—To provide adequate and proper illumination for the visual tasks involved in machine shop work.

CONSTRUCTION DATA—This large area machine shop is of brick and steel construction. Steel columns, girders and beams support a wood saw tooth roof. The distance from the bottom of the girders to the floor is approximately 15 feet. All conduit, water and steam pipes are run under the girders.

SOLUTION OF PROBLEM—General illumination is produced by 345 RLM type fluorescent units, each with two 40-watt white fluorescent lamps. The units are spaced on 10-foot by 13-foot centers and mounted 11-feet from the floor. This brings them below the pipe obstructions and eliminates shadows. Each fixture is chain suspended from the wood roof and fed from the original exposed conduit lighting circuits.

RESULTS—The average illumination intensity on the working plane, three feet above the floor, is 21 foot-candles.

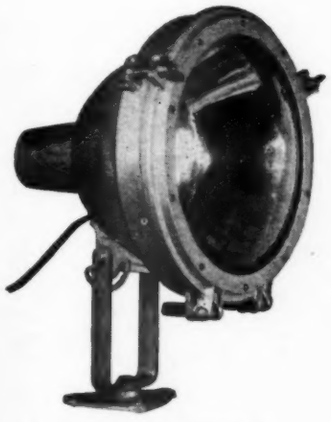


PLAN VIEW *showing the location and spacing of the fluorescent units.*

RLM FLUORESCENT *fixtures produce high intensity lighting in the machine shop of this mid-west manufacturing plant.*

WESTINGHOUSE supplies the answer

For both protection and night operation, a carefully engineered floodlighting system illuminates this vital pipe storage yard.



Westinghouse Type CAK, heavy-duty, cast aluminum floodlight.

FOR THE PROTECTION OF NIGHT-TIME PRODUCTION

Tonight, and every night, persons, property and production are in danger from the slinking saboteur. And as defense operations gain momentum, the need for *adequate* industrial floodlighting becomes more pressing than ever before in the nation's history.

Protective lighting creates a continuous barrier of light, a virtual wall, around an entire industrial site. With light directed away from buildings and toward fence lines, would-be intruders are blinded by the full glare, while watchmen, behind the light sources have a clear view of the approaching saboteur. Within the plant area too, yards, building approaches and alleyways are illuminated.

Your Westinghouse Lighting Distributor, with complete lighting equipment, offers the services of skilled illumination engineers to help "supply the answer" for adequate protective lighting. A new book, "Floodlighting for Protection and Production," B-2280 is available for Industrial Plant Executives. Write Westinghouse Electric & Manufacturing Co., Edgewater Park, Cleveland, Ohio.

117 Westinghouse Electric Supply Company offices and Independent Lighting Distributors provide local stocks and services.

Westinghouse Lighting Equipment

Motor Shops

PORTABLE HIGH CURRENT TEST SET

Howard Davies, motor repair and test specialist of Philadelphia, Pa., uses a 110 volt to 6 volt transformer for testing small motor armatures and commutators. The unit has a carrying handle and a snap switch in the primary circuit.

It is used primarily to check solder connections by shooting a high current through the commutator segments, but it can also be used for checking short circuits in armature windings, when used with instruments as shown in the

***ARMATURE TESTING** is a simple chore with this high current test set. Used to check solder connections and. with the aid of meters, short circuits in the windings.*

photograph. The unit gives better than 80 amperes, but the current can be reduced by placing a resistance in the primary circuit.

ROTATION INDICATOR

Positive check of the direction of rotation of the field on single phase motor repair jobs is made before assembly at the W. M. Smith Electric Co. shop in Dallas. A small tool designed by superintendent T. A. Hermans makes a quick test.

Terminal leads from the stator windings are hooked up to test leads and

***DIRECTION OF** field rotation of single phase windings is indicated by miniature rotor on tool handle.*

energized. A small rotor consisting of a copper band around a fiber pulley rotating on a spindle is inserted in the field. The rotor spins with the field.

The tool handle spindle is 6-inches long. The fiber pulley and copper rim is 1¼-inches in diameter, 1-inch wide.

STRIP COPPER BENDER

A bending machine for making hairpin bends in rectangular strip copper for building up coils, has been designed and constructed by the Economy Electric Co., motor repair shop of Youngstown, Ohio.

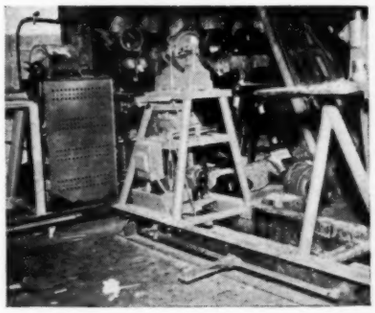
***HAIRPIN COIL** bender for bending copper strip used in building up rectangular copper coils.*

The machine consists of an L shaped cast iron bracket which is bolted to the work bench. It supports a freely rotating collar to give free movement to the copper being bent and the bending mechanism itself. This mechanism consists of a bolt, threaded on one end, to which is attached the operating handle and a solid metal disk which is keyed to the bolt. On the perimeter of this disk is a small pin which guides the copper around the bolt when the handle is turned. An adjustable metal disk, which turns on the threaded part of the bolt, rests flush against the side of the strip copper and keeps it from buckling while being bent. The two bolts by the operator's left hand (see photo below) are for mounting a guide bar which is used as a measuring device for smaller coils. Copper strip up to 1-inch in width can be bent in this machine.

ADJUSTABLE BRAKE TREADLE

Convenient foot operated control from any position on a winding lathe in the San Antonio Armature Works at San Antonio, Tex. is provided by a pivoted square control bar and a sliding treadle.

The control bar is four feet long,



***TREADLE BAR** allows foot operation from any convenient position.*

located at the base of the winding lathe. A treadle slides along the bar and may be placed in any convenient position. Depressing the treadle operates a clutch and brake on the lathe lead.

The machine is operated by an individual motor drive through a gear shift providing a choice of operating speeds.

HANDY SHOP HOIST

This 1½-ton portable hoist proves to be a handy piece of equipment in the motor shop of the Electric Motor Repair Co., Springfield, Mass.

It can be operated by one man and is used for moving heavy equipment

Get Extra Protection In Unusual Atmospheres with Century NEW, IMPROVED TOTALLY ENCLOSED FAN COOLED MOTORS

● New, improved Century Totally Enclosed Fan Cooled Motors provide necessary protection where the air is foggy with metal cutting solutions, or there are abnormal quantities of metallic, abrasive and other dusts in the atmosphere that would ordinarily injure or clog the windings of a general purpose open motor.

The vital parts of a Century Totally Enclosed Fan Cooled Motor are completely enclosed. In reality, this is a totally enclosed motor, built within a cast iron protecting frame which provides ventilating passages and a fan for cooling.

A blast of cooling air is produced by the non-sparking fan inside the pressed steel fan housing. The air is forced through passages between the cast iron frame and the motor laminations, but outside the protective enclosure.

The forced air cooling system keeps the large smooth air passages clean. The intake openings in the fan cover are not easily clogged and there is safety in the fact that a 5/16" rod will not pass through the intake openings in the fan cover.

The modern streamlined exterior of these new Century Totally Enclosed Fan Cooled Motors blends well with modern equipment design.

These motors are also available constructed to meet the specifications of, and carrying the label of, Underwriters' Laboratories, Inc., for Class II Group G installations.

If atmospheric conditions are a problem in your plant, consult your nearest Century Motor specialist. His experience with the same or similar problems is always at your service—may well save you time and money.

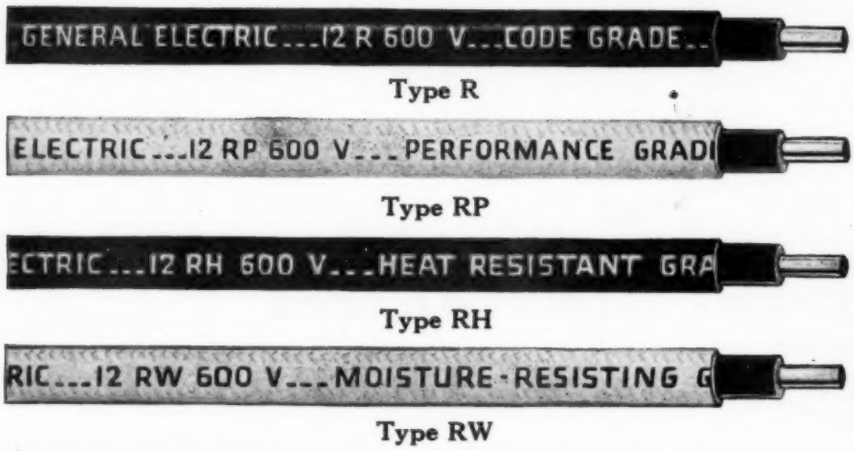
If you have not received Century TEFC Motor Bulletin No. 048A, write today.

CENTURY ELECTRIC COMPANY
1806 Pine Street St. Louis, Mo.
Offices and Stock Points in Principal Cities

Century MOTORS

One of the Largest Exclusive Motor and Generator Manufacturers in the World

LOCAL SERVICE *Everywhere* ON G-E BUILDING WIRE



G-E Distributors Located at All Key Points in Country

You can obtain high-grade G-E building wire from a G-E distributor right in your own territory. Think of this advantage in the present building rush.

Moreover, you can save additional time when installing G-E building wire because it is easy to use. It is easy stripping, clean stripping and easy pulling. Each wire has its size, type, voltage and grade of insulation printed on the braid for quick identification. Braids are available in different colors.

G-E building wire will give good service. It is made of quality materials according to rigid specifications. Conductors are accurately and uniformly centered in the insulation.

For further information see the nearest G-E Merchandise Distributor or write to Section W-184, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

GENERAL ELECTRIC

Motor Shops

[FROM PAGE 46]

of all types. It is especially valuable for lifting heavy armatures into lathe beds, since the armature can be lifted high, the hoist rolled under the lathe base and the equipment lowered into place.

The "U" shaped base of the hoist straddles equipment or machinery supports, hence sliding and swaying is

HANDY HOIST straddles equipment and machinery supports and facilitates one-man handling of heavy equipment. It is especially useful for placing large armatures in lathe beds.

eliminated when hoisting or lowering motors or other equipment. The hoist mechanism is operated by a crank and has a built-in locking device to prevent the load from slipping. The handle used for moving the hoist always returns to an upright position—out of the way.

INSULATION CUTTER AND CREASER

A piece of equipment that cuts and creases slot insulation at the same time has been designed and built by the Standard Electric Motor Repair Co., motor shop at Linden, N. J.

The apparatus consists essentially of two $1\frac{3}{8}$-inch rolls, geared to turn in opposite directions and each having a keyway along its entire length. The top roll has three collars keyed to it, one with a sharp cutting edge and the other two with blunt edged flanges, mounted so the flanges face each other. The bottom roll also has three collars keyed to it, one with a cutting edge and two which form a groove in which

Industry Needs *FAST* Interior Communication ★★★★

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Don't neglect to remind your customers and prospects that you can supply Automatic Electric private telephone systems to meet their special requirements.

The four types now most in demand are presented below. The entire Automatic Electric line is illustrated and fully described in Catalog 4033-A.

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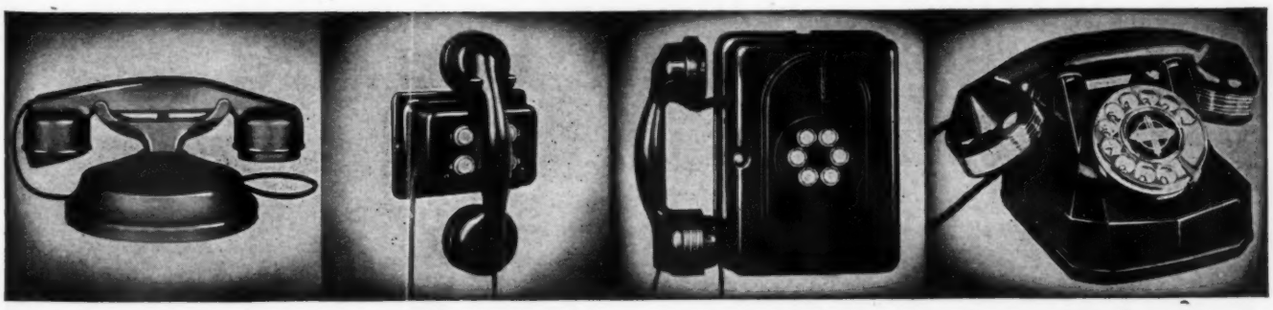
Automatic Electric intercommunicating systems are designed for private service. They are not intended to be connected with the public telephone system.



SERV-U-FONES

Low priced, all metal telephones, in common talking systems of two to ten stations. Conveniently packaged and simple to install.

IDEALFONES

Wall type with molded handsets. Offered with one or five buttons for common talking service up to ten stations.

INTERCOMS

Supplied in both desk and wall styles—with molded plastic handsets. Common talking systems of two to eleven stations.

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SAVE HOURS OF HARD WORK WITH GREENLEE PUNCHES

Greenlee Knockout Tools were developed to do in a few minutes a job that formerly required hours. Now you can enlarge knockouts and holes in metal without the long tedious job of drilling, reaming, and filing. A Greenlee Knockout Cutter or Punch can be easily inserted in a knockout or a small drilled hole, a few turns of the drive nut with an ordinary wrench, and a hole up to 3½ inches can be cut in 1½ minutes or less. These tools will cut a clean, round hole in bakelite, hard rubber, or any type of metal up to ⅛-inch thick. Greenlee Punches are available in eight sizes for cutting holes from ⅞ to 3½-inches. The Greenlee Knockout Cutter will cut 1-15/16, 2⅜, 2⅞, and 3½-inch holes.

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• Send me the new S-114 Bulletin on Greenlee Knockout Punches and Cutters

Name.....

Address.....State.....

City.....

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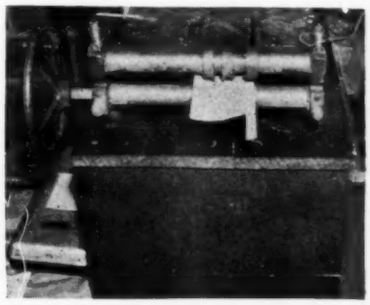
GREENLEE TOOL CO.

1706 Columbia Ave. • Rockford, Ill.

[FROM PAGE 48]

the flanges of the top blunt edged collars ride. The edges of the two cutting collars overlap about ¼-inch. The others overlap just enough to produce a well rounded, crackless crease in the insulation. Pressure adjustments are made by two set screws tightened by key wrenches. The set screws in the collars are also adjusted with key wrenches. All collars are adjustable for various slot widths and depths.

Two adjustable angle iron guide rails, mounted on a steel plate, guide the insulation into the cutting and creasing collars. A large diameter wheel connected to the lower roll provides ample leverage to operate the mechanism. Thus, in one operation long strips of slot insulation can be simultaneously creased and cut to the proper width. The creased sheet is then cut to the proper length for the particular job at hand.



CUTTING AND CREASING of slot insulation in one operation is made possible by the use of this machine. It has proved to be a helpful time-saver in this motor shop.

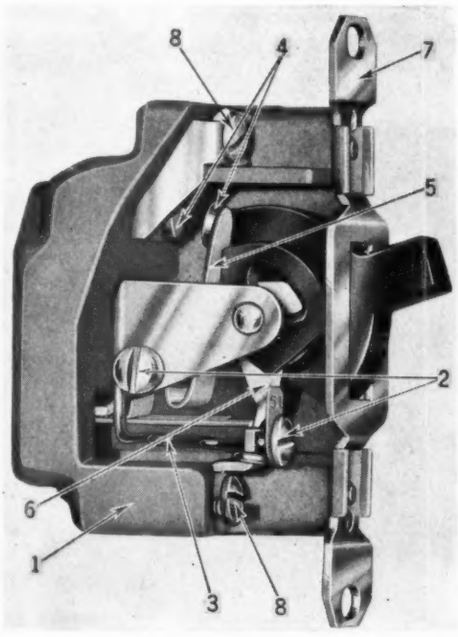
ARMATURE BANDING machine in the shop of the Electric Motor Repair Co., Springfield, Mass., saves 25 percent on labor and increases quality of work by 25 to 50 percent—over the best possible job that can be done on a lathe. A swinging arm counter-weighted tension device assures tight, closely wound bands. Foot operated switch leaves both hands free to guide the banding wire.

KEEP IN CIRCUIT

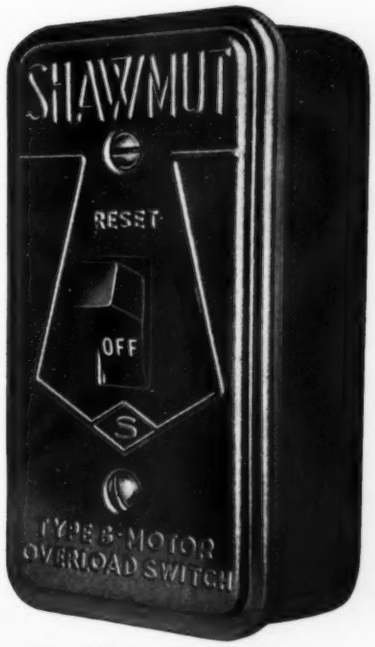
with electrical equipment that means time saved, money saved, and the fullest measure of security in operation. Use the

SHAWMUT TYPE B MOTOR OVERLOAD SWITCH

on air conditioning apparatus, refrigerators, washing machines, fans and blowers, pumps and compressors, floor polishers, oil burners, saws, small grinders, stokers, small printing presses, small conveyors, machine tools, and all similar motor-drives.



The Shawmut Type B Motor Switch is a manually operated auxiliary circuit breaker, combining on and off switching with positive thermal overload protection. Designed for use with fractional-horse-power motors; maximum rating, single pole 1 h.p. 115-230 volts A.C. Sturdy, simple, compact; easy to install and wire; long electrical and mechanical life.



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NEWBURYPORT, MASSACHUSETTS

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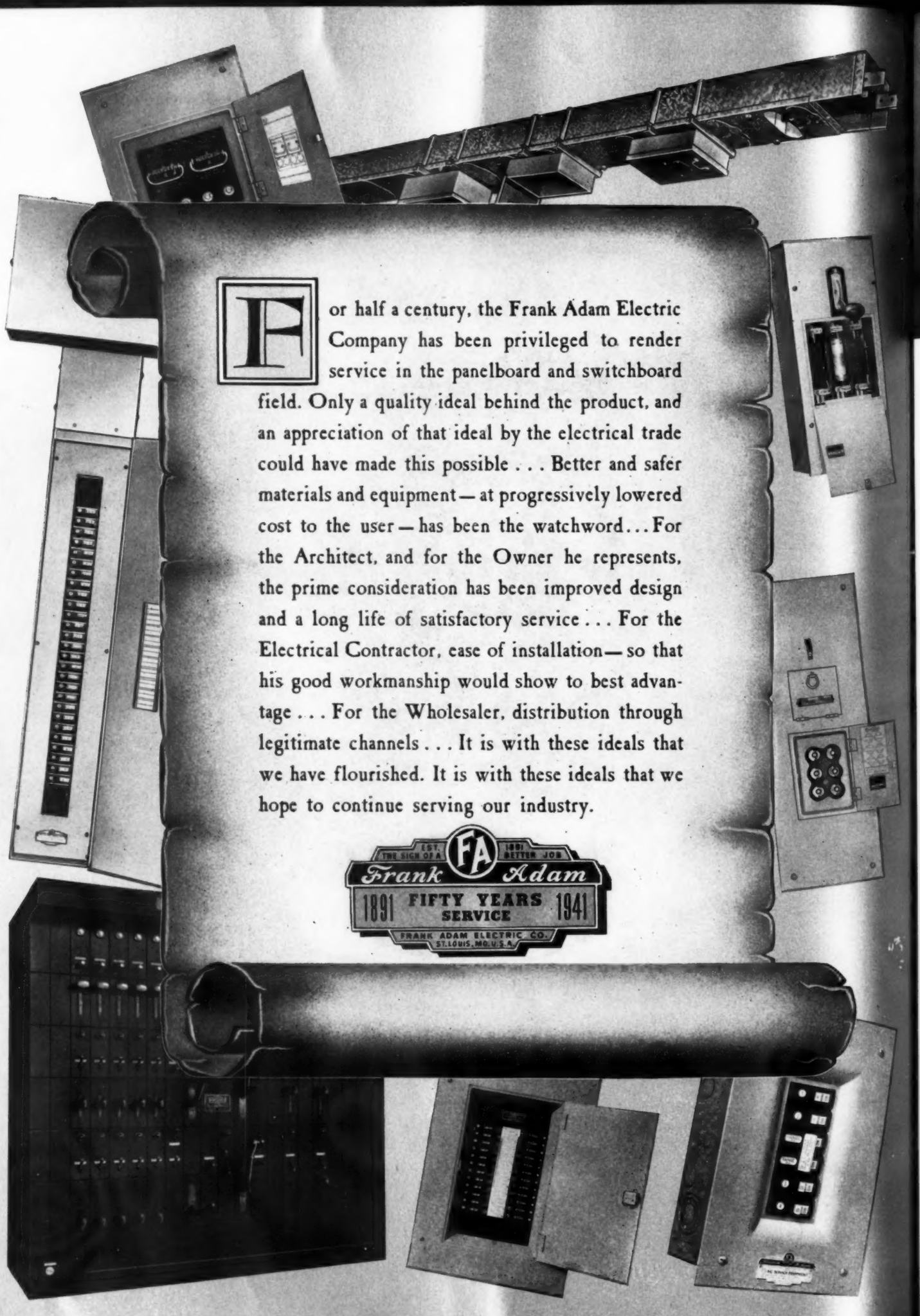

For half a century, the Frank Adam Electric Company has been privileged to render service in the panelboard and switchboard field. Only a quality ideal behind the product, and an appreciation of that ideal by the electrical trade could have made this possible . . . Better and safer materials and equipment — at progressively lowered cost to the user — has been the watchword . . . For the Architect, and for the Owner he represents, the prime consideration has been improved design and a long life of satisfactory service . . . For the Electrical Contractor, ease of installation — so that his good workmanship would show to best advantage . . . For the Wholesaler, distribution through legitimate channels . . . It is with these ideals that we have flourished. It is with these ideals that we hope to continue serving our industry.

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1891 FIFTY YEARS SERVICE 1941

FRANK ADAM ELECTRIC CO. ST. LOUIS, MO. U.S.A.

Industrial Electrification and MAINTENANCE

UNIT COST REDUCTIONS

ONE of the prime considerations of industrial management today, is the reduction of unit costs to the lowest possible level. The overall cost of a product has a component unit cost in each plant department. If one of these should increase due to product changes, demand fluctuations, labor conditions, or a host of other relevant factors, methods must be devised for the reduction of the other component costs to prevent an overall increase.

When such a condition arises, the maintenance man should be able to offer pertinent suggestions, based on his knowledge of production operations throughout the entire plant. For electricity is a useful servant and in many cases electrification of certain operations will prove economical. Also, the various types of remote control devices on the market today, when applied to individual or group operations, will transform much of the operator's non-productive labor into actual production.

There are many problems which are common to a number of industries, especially where mass production methods are used. And the electrical solution used in one plant may be applicable to others. With this in mind we present, in the following pages, several case studies of operations that were electrified to reduce unit costs. The Maintenance Guide Sheet lists a number of questions which, if reviewed carefully, will show the maintenance man possible electrical applications for reducing production costs in his plant.

Previous articles covered—

1. Simplifying Electrical Maintenance
2. Preventive Maintenance of Distribution Systems
3. Preventive Maintenance of Electrical Equipment
4. Reducing Power Costs
5. Maintaining Good Power Factor—Part I
6. Maintaining Good Power Factor—Part II
7. Meeting Severe Service Conditions
8. Eliminating Causes of Severe Service Conditions
9. Providing Adequate Capacity for Increased Demand
10. Electrifying Operations to Reduce Unit Costs (this issue)

Future articles will discuss—

11. Increasing Flexibility of Electrical Service
12. Safety Protection for Electrical Operations
13. Extending Automatic Control
14. Methods for Handling Changeovers and Live Circuits

ELECTRIFYING OPERATIONS TO REDUCE UNIT COSTS

DURING these strenuous times, management is straining to keep costs down. These costs may be affected from many directions, such as changes in the product, fluctuations in product demand, adding of new products, variations of output for different types or models of machines, changes in labor or conditions, and changes in production methods and operations.

When these changes increase the manufacturing cost, ways must be found to decrease the component unit costs, and every official in the factory must make his contribution in suggestions. The electrical maintenance man has unusual opportunity because of his knowledge of individual operations throughout the plant. Men whose work centers in one production department are apt to feel that present methods are the best possible, but the electrical maintenance man has many resources. He is posted on the latest developments and applications of electric equipment. He is in a position to make recommendations for electrifying operations and thereby can often help to reduce unit costs in unexpected ways.

What are the operations that can be electrified? In the beginning, few opportunities will reveal themselves, but it will pay to carefully review the operations that are being performed as the work goes through the plant and analyze them from the standpoint of labor and time saving. A large number of these operations are common to many plants and the experience of others may be helpful. Only a few can be considered here, but we will present a few that are typical, such as drying, finishing, fabricating, handling, shearing. These involve problems on which there is often a simple electrical solution. To find these solutions, the maintenance man may well study the latest practices elsewhere. Very often the answer may be found in another industry.

Here, therefore, are a few such examples showing how maintenance men have applied electrical principles to solve their company's cost problems—

1. Drying

(A)—Radiant heat has been found helpful in speeding production with convenience and low costs at Cupples-Hesse Envelope and Lithograph Co., St. Louis. In this plant glassine and cellophane bags for hosiery, potato chips, pop corn, and other products are "kiss-printed" from rubber plates.

INFRA-RED LAMPS *reduce drying time of "kiss-printing" on cellophane bags. Production is increased to 5,000 bags per hour at Cupples-Hesse Envelope Co., St. Louis.*

STEEL DONKEY, operated by a winch, conveys 4,000 lb. of metal sheets from freight car, and raised performance from 2,500 lb. to 13,000 lb. per man-hour.

Formerly a home-built electric heater was used to dry the ink. The heater consisted of resistance wire placed inside a shell of iron. The shell had to be heated before heat could be transferred to the cellophane tissue. But the unit "leaked" heat in all directions.

Infra-red lamps of the reflector type replaced the iron heater. These lamps direct the heat to the spot. Both oil and aniline inks are dried successfully and production is up to 5,000 bags per hour.

(B)—Electric unit heaters reduced drying time of a plating operation for mirrors. The operation was carried on in a basement but the drying of the plating liquid was slow because of the humidity, especially in the summer.

To solve this problem an enclosure was built on one-half of the drying table. From one end of the enclosure two forced-convection heaters blow heated air over the mirrors. The fans on the heaters can be operated when the heating elements are de-energized.

With this arrangement drying time was reduced to 15 minutes. The quality of the product was improved also by eliminating trapped moisture on the back of the mirrors.

2. Unloading a Freight Car

Installation of an electric winch and use of a "steel donkey" enabled a western stove manufacturer to save man-hours in unloading sheet metal from freight cars. Previously only a couple of sheets could be handled at one time. With the donkey, the sheets are handled in large batches.

The donkey is pushed into the car by hand, picks up approximately 4,000 lb. of sheets, and by the electric winch is pulled from the car to a platform inside the plant. The winch is inside the plant and is controlled by a push button at the unloading door. With this method of handling the amount of material handled has been raised from 2,500 lb. to 13,000 lb. per man-hour.

3. Finishing

High-cycle sanders are employed by a Cleveland fabricator to dress off spot-weld marks and give a fine finish on movable steel partitions, doors, and accessory equipment. They have improved the efficiency and speed of the finishing operation by use of 180-cycle sanders which operate at 5,400 r.p.m. The 220-volt, 180-cycle power for the sanders is supplied by a frequency-changer set operating from a 60-cycle circuit.

Increased output and lower production costs quickly repaid the investment in high-cycle sanders. These portable tools have higher and more uniform speed and reduced maintenance charges.

4. Fabricating Metal Parts

(A)—Electric arc welding was found to be the quickest and cheapest method in fabricating angle-iron framework in a sheet metal shop in western Pennsylvania. The cost was reduced 50 percent by this method as compared for the same operation by acetylene welding, with no specially trained operator. In the same shop, arc welding is being used economically for building machine guards, for repairing machinery, and for joining light sheet metal.

(B)—By using four types of electric welding, a shovel manufacturer was able to reduce costs and, in addition, increase strength and improve appearance of strap shovels.

The types of welding and the operations are: (1) by arc welding, they weld two edges of the shovel socket with a welding rod. It has replaced acetylene welding. (2) by butt welding, they join back strap of shovel to the blade. This replaces riveting. (3) by seam welding, they weld the edge of the front strap to the shovel blade. This has replaced a fire and hammer weld. (4) by spot welding, they have fused the front strap and the blade of the shovel at two points. This has replaced riveting. Spot welding is also used to fuse two edges of the handle casing to an insert. This was a new operation.

The most important operation is electric seam welding. In this operation the heat is accurately controlled by thyratron tubes. Since seam welding was adopted the number of front-strap miswelds has been practically nil.

5. Annealing Bronze Tubes

An electric furnace with automatic temperature control has cut rejects 15 per cent and reduced annealing costs 10 percent for a manufacturer of heat-control devices. Here variations in wall thickness and inside diameter, and irregularities in grain size were found in purchased drawn-bronze tubing, one inch in diameter. These inconsistencies caused rejections of 15 percent of each production lot.

The company decided to draw the bronze tubes from disks, in the plant. For a tube 18-in. long, 10 drawing operations are necessary. After drawing, the tubes are sent to the pickling bath, and then annealed in a 27 kw. furnace to return the grain size of the metal to the original state. The furnace temperature is held at 1125 deg. F. for annealing.

6. Heating a Solution

An immersion heater has been found to be most satisfactory for bringing a colloidal solution to temperature and keeping the temperature uniform and precisely controlled. This is reported by the maintenance superintendent of an offset-press manufacturer.

In order to eliminate loss of a mixture, scorching must be avoided when heating the colloidal solution for coating photographic plates used in offset printing. The temperature of the mixture is controlled as follows.

Water in a glass-lined and insulated tank is heated to 170 deg. F in about an hour, by a 5 kw. immersion heater. Then a motor-driven agitator is put in and powdered colloidal substance is added. During the mixing, the heater remains in the solution for about two hours.

HIGH-CYCLE SANDER improved efficiency and speed of finishing off spot-weld marks.

MAINTENANCE GUIDE SHEET

ELECTRIFYING OPERATIONS TO REDUCE UNIT COSTS

This list of 30 questions will help in reviewing the possibilities in any factory, to determine where delays can be avoided, operating time can be reduced, man-hours can be saved, spoilage can be eliminated, waste can be minimized.

1. How can savings be made by shutting down boilers, without loss of steam for some specific operation?
2. How can drying time of ink, lacquer, or enamel be reduced?
3. How can space be saved for drive to a line shaft or to arrange a machine for individual drive?
4. How can machines be re-arranged without the necessity of new branch-circuit runs?
5. How can hidden flaws in rough or finished parts be detected?
6. How can interruption be avoided due to failure of electric equipment because of dust or moisture?
7. How can fumigants be volatilized in shorter time?
8. How can time lost because of fuse blowouts on temporary overloads be eliminated?
9. How can dust containing valuable particles be reclaimed?
10. How can loss of glue between uses be reduced?
11. How can beef and other meat products be aged in shorter time?
12. How can losses due to sticking of ceramic material in dies be prevented?
13. How can rejects of heat-treated parts be reduced?
14. How can the number of operations in joining light-gage parts be reduced?
15. How can man-hours be reduced in unloading cars?
16. How can idle time waiting for material be eliminated?
17. How can loss of materials be reduced due to atmospheric changes?
18. How can time be saved in delivery of messages or obtaining information?
19. How can inspection, grading and color matching be speeded up?
20. How can wider range of speed step up output where only a-c power is available?
21. How can spoilage from spotting by insects be reduced?
22. How can damage from piling up of parts be reduced?
23. How can interruptions from defective electric equipment in hazardous locations be avoided?
24. How can savings be made by salvaging cast iron borings?
25. How can time be saved by bringing batches more quickly to temperature, and closely controlled?
26. How can interruptions due to jamming of imperfect boxes on inclined conveyors be eliminated?
27. How can time be saved by quick identification of small tools?
28. How can delays by non-free flow of materials in hoppers, bins, or chutes be avoided?
29. How can operator be relieved of extra steps to start and stop machine when setting-up work?
30. How can shut-downs be eliminated when service voltage dips or power interruption is less than 4 seconds?

If you are not satisfied with your own answers to the above questions, the following suggestions will help to determine which equipment to use for electrifying the operations involved. Items are numbered for the respective questions.

1. Use electric steam generators.
2. Use infra-red lamps, induction ovens, convection heaters or strip heaters.
3. Use gearmotors.
4. Use flexible electric distribution.
5. Use x-ray equipment.
6. Use dustproof or moisture-proof equipment.
7. Use electric heaters.
8. Use quick-reset circuit breakers.
9. Use an electrostatic dust precipitator.
10. Use glue heating pots.
11. Use sterilamps.
12. Use cartridge heating units in dies.
13. Use a heat-treat furnace and controlled atmosphere.
14. Use spot welders.
15. Use an overhead hoist or portable conveyor.
16. Use electric trucks.
17. Use air-conditioning equipment.
18. Use an inter-communicating system.
19. Use fluorescent lamps.
20. Use an a-c variable speed drive unit.
21. Use insect electrocuters.
22. Use photoelectric control or limit switches.
23. Use explosion-proof wiring, motors and control.
24. Use an arc furnace.
25. Use an immersion heating unit and thermostat.
26. Use photoelectric control.
27. Use an electric etcher.
28. Use an electric vibrator.
29. Use push buttons.
30. Use a time-delay relay.

***PORTABLE SHEAR** minimizes waste in cutting operation on tops for kitchen sinks.*

7. Joining Aluminum Parts

Spot welding has eliminated three operations in attaching handles and fittings to aluminum cooking utensils. For years, rivets were used but riveting involves punching or drilling holes, inserting rivets, and forming the heads.

By the spot-welding method, with only one operation the parts are clamped together under carefully controlled pressure (400 to 800 lb.) and a relatively high current (approximately 30,000 amp. at 12 volts) is applied for a predetermined time. Special timing equipment controls the "on" period (usually between 0.05 to 0.20 sec.) so that the fused or welded area is localized to the surface between the spots.

8. Feeding Wire

A fractional-horsepower motor and a solenoid-operated cutter have eliminated manual operations and most supervisory work in the manufacture of mattress springs. Here hand feeding, hand cutting, and special supervision were required when manual machines were used to make helical springs of Nos. 17 and 18 spring wire, three turns to the inch.

The machine driven by a ½ hp. geared-head motor passes the wire from a coil through straightening rolls, a tool-steel die and to a shear. A ⅛-in. knife blade, shears the wire in predetermined lengths, without distorting it. If any springs cramp or any are to be straightened out, no extra operations are necessary because the feed of the machine can be reversed.

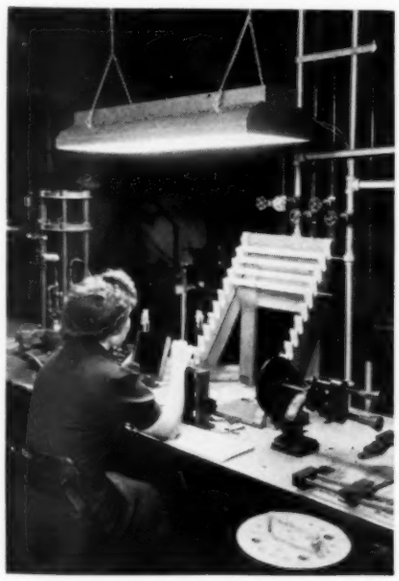
9. Shearing Metal

Use of a small electric shear has minimized waste of metal for drain boards at kitchen sinks, in a Philadelphia plant. Here modern kitchen equipment is made and cutting out metal of sufficient size for a sink was formerly a manual operation with a cold chisel and hammer. The part cut out had to be scrapped. It weighed about 2 lb. and was worth approximately $1.50.

Now this cutting operation is done with a portable electric tool—a shear—which does a smoother job. The metal cut out is in one piece and is salvaged. In addition, time and money are saved.

10. Packaging Bottles

Before photoelectric control was installed in a bottling plant, 54 people would be idle for one-half hour whenever the maintenance crew had to remove cases from a conveyor. A case would sometimes become jammed on an elevator, and this trouble would happen four and five times a month.



***FLUORESCENT LAMPS** aid in inspection, reduce heat discomfort. Three 36-in. Westinghouse lamps in a diffusing fixture provide 100 foot-candles. Added feature is daylight approximation, important in color matching.*

Two elevators removed the cases from one conveyor line and discharged them on another conveyor on the third floor. When a case would stick at the elevator discharge, the jamming of other cases would damage at least one case and cause interruptions in packaging.

The electric eyes now automatically shut down the elevator before an imperfect case can cause a jam. When the faulty case is removed, operations can be resumed immediately. Since this installation was made, over 800,000 cases have been handled, the elevators have not been jammed, and wasted man-hours have been eliminated.

11. Cleaning A Product

A motor-driven machine with an abrasive blast has eliminated breakage for an Indiana foundry supplying lamp bases to about 150 lamp manufacturers in the mid-west. Cleaning by sand-blast and tumbling took too long, and tumbling was the cause of considerable breakage. And production schedules could not be met in busy seasons.

A new equipment, known as a Wheelabrator Tablast was installed. It provides a continuous cleaning operation. Bases are loaded on a circular conveyor which passes under an abrasive blast. Both the conveyor and blast have individual motors.

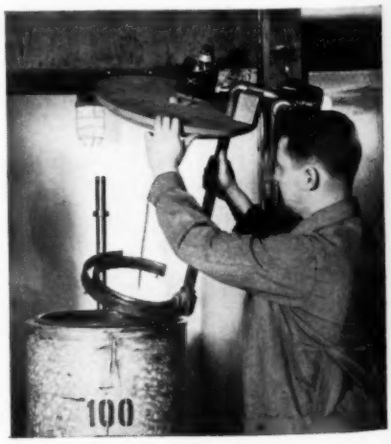
As a result, the cleaning rate was stepped up to 420 bases an hour and breakage was eliminated. In addition, the bases have an improved finish, "silvery matte," which is ideal for enameling, painting, or lacquering.

12. Fumigating

An installation of 1,000-watt trough heaters made possible a reduction in time in fumigating furniture for a Toronto, Canada store. Demothing used to be a 24-hr. job but now it is an 8-hr. job because the increased amount of heat speeds volatilization of the fumigant. The heaters raise the temperature in the vault and a recirculating blower steps up air movement.

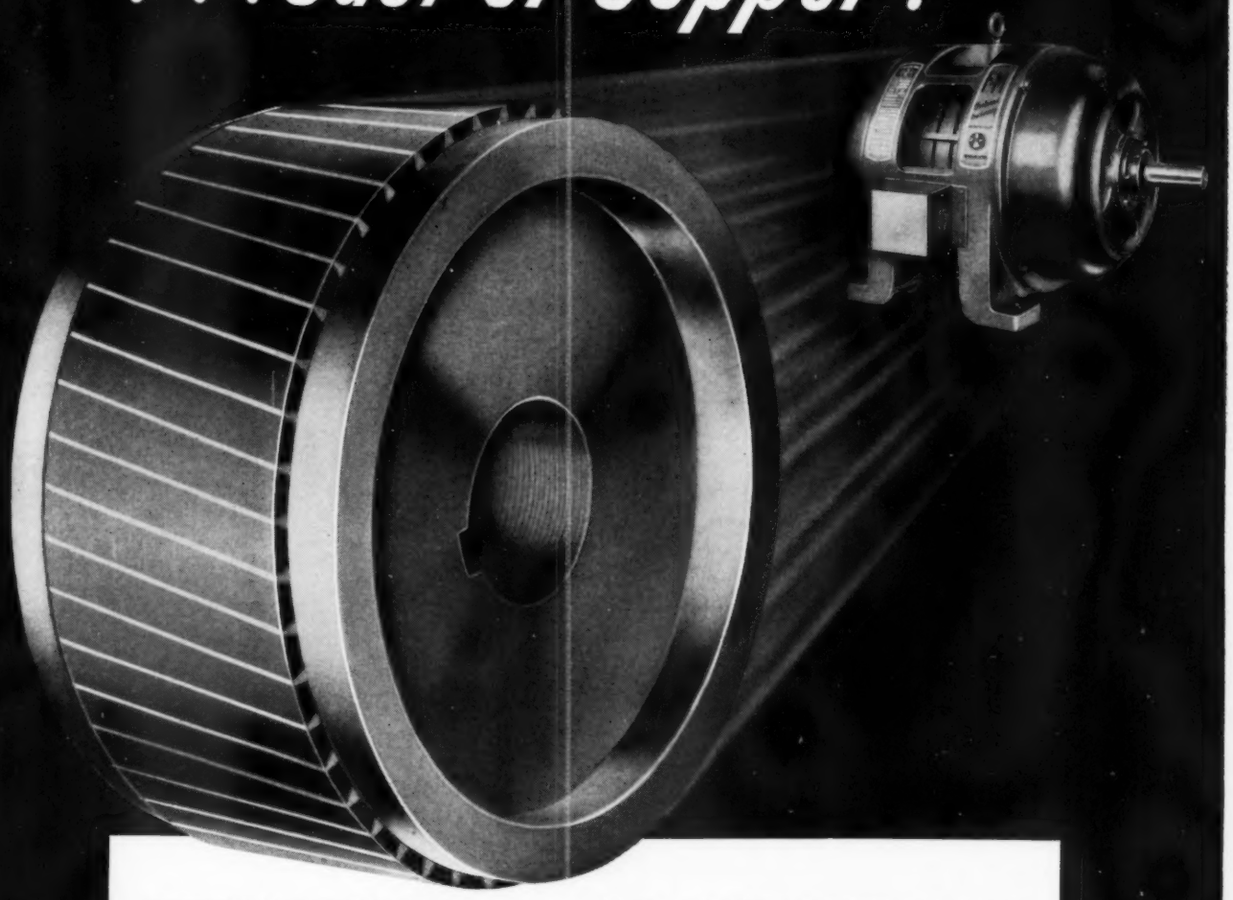
Summary

Each plant, of course, has its individual operating and cost problems. But a discussion with the cost department and a trip in the plant to analyze respective operations will often reveal how some of these costs can be reduced by electrifying operations. To assist the electric maintenance man to further analyze his problems on reducing costs, a list of 30 questions and electric equipment for the solutions to the problems are given in the Guide Sheet.



***MOTOR-DRIVEN AGITATOR** and immersion heater prevent scorching when colloidal solution is being heated and mixed. Agitator (not shown) extends through tank cover and is mounted on upright post at rear of tank.*

An INDESTRUCTIBLE Rotor
. . . Cast of Copper !



THIS indestructible, one-piece rotor with windings centrifugally cast of SOLID COPPER is found only in Fairbanks-Morse Motors.

It's a rotor that does more than meet the tempo of today's industrial needs . . . it sets a *new standard* of motor performance. For *only in this rotor* are the advantages of a one-piece winding combined with the advantages of *copper.*

Copper has a high melting point (2000° F.)*, high electrical conductivity, and low thermal expansion. And so F-M Motors, with patented features available only in Copperspun rotors, better withstand constant starting and reversing, give added years of dependable operation, and minimize operating costs.

*Aluminum melts at 1100° F.

Worth your consideration are the advantages in your service of Fairbanks-Morse Motors with Copperspun rotors. Write Fairbanks, Morse & Co., Dept. D25, 600 South Michigan Ave., Chicago, Ill. Branches and service stations throughout the United States and Canada.

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Patented

FAIRBANKS·MORSE MOTORS

DIESEL ENGINES ELECTRICAL MACHINERY RAILROAD EQUIPMENT WASHERS-IRONERS STOKERS
PUMPS FAIRBANKS SCALES WATER SYSTEMS FARM EQUIPMENT AIR CONDITIONERS

FAST CAPACITORS

EASY TO INSTALL
RELIABLE IN SERVICE

Use FAST CAPACITORS for better voltage regulation, reduced feeder losses and improved power factor. It's the cheapest and fastest way to reduce losses and raise the voltage at the motors.

You will find a design and rating to suit your need. Well designed, carefully assembled, rigidly tested FAST CAPACITORS are reliable in service. Write for catalogue No. 20 to-day for a listing of industrial capacitors.

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Speed **DEFENSE PRODUCTION**

***with* BUNTING STANDARDIZED BEARINGS**

● Every day in almost every factory they are digging up old motors and putting them to work. Remember that every size and make of electric motor requiring bronze bearings can be serviced from Bunting's Standardized Bearings instantly available from stock. The Bunting Brass & Bronze Company, Toledo, Ohio. Warehouses in All Principal Cities.

● This catalog makes it easy for you to select the Bunting Bronze Bearing required for any job. Write for copy.

BUNTING

BRONZE BUSHINGS · BEARINGS
PRECISION BRONZE BARS · BABBITT METALS

Use of Instruments in Maintenance

Without an adequate set of electrical measuring instruments, a maintenance man would be as helpless as a ship without any navigating instruments or compass.

The use of instruments in maintenance is more often determined by the nature of the particular job at hand. However, some measurements may be made as routine procedure at the beginning of any maintenance procedure on electrical apparatus.

An example—Some maintenance men make it a rule to first check insulation resistance to ground on any apparatus whether the job is a routine inspection or a service call. This can be done conveniently with a voltohmmeter or a megger.

Some maintenance applications of instruments are as follows:

1—Voltohmmeters or meggers for checking resistance and exploring voltage in control circuits.

2—Voltmeters, ammeters, and wattmeters for checking load factor and determining proper size in applications of motors.

3—Industrial analyzer for checking load factor and determining proper size in application of motors to all classes of motor operated machines.

4—Recording voltmeters, ammeters, and wattmeters to determine load cycles of machinery in relation to possible overloads and burnouts, also to quality of product.

"Electric Eye" Control

Electric control utilizing a phototube, generally known as "electric eye" control, has been used in industrial plants for counting, measuring, operating, and performing other tasks that are too fatiguing or fast for human eyes and hands.

A domestic counterpart of the industrial unit, only half as large as a loaf of bread and known as the Westinghouse Phototroller, has been put to work in private homes. Some uses are: automatically opening a garage door when a car approaches; opening a dining room door for the housewife or servant who is using both hands to carry dishes; switching on house lights when anyone enters at night; as well as other switching operations the home experimenter can find for it.

Some industrial applications, including protective measures, are prompted by the domestic uses. They are: operating signals when a car or a person approaches a gate house; switching on lights when anyone enters a building,

department or office; switching on yard, fence, sign, and marker lights at a predetermined low intensity of natural light; automatically opening doors between departments when people or trucks approach; equalizing illumination in departments when heavy clouds or early dusk reduce natural light.

$30 Monthly Saving On Power Bill

As a result of raising the plant power factor from 74 to 96 percent by the installation of a 45-kva capacitor, the Janesville, Wisconsin, plant of Bowman Dairy Co., Chicago, average a $30-a-month saving on their power bill during a 2-yr. operation. At this rate, the installation paid for itself out of savings in about 16 months.

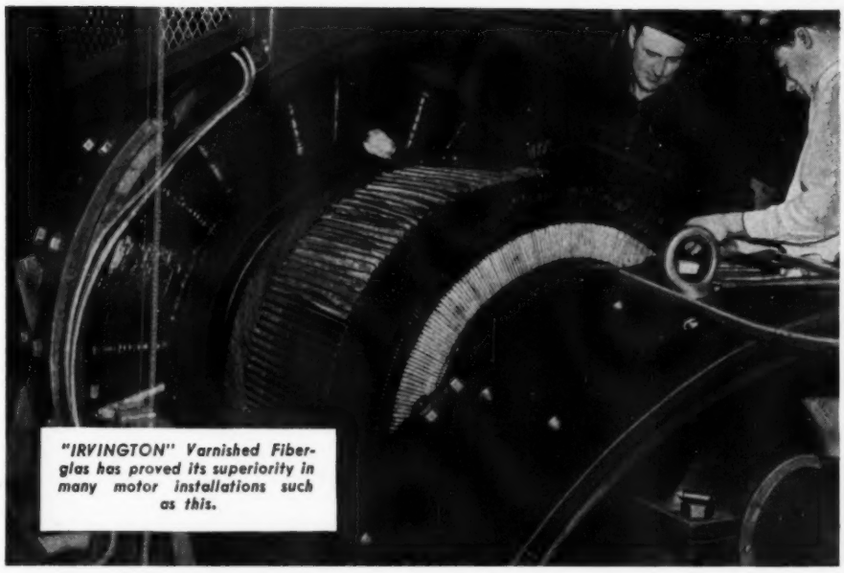
Like most dairies, the electric load in the Janesville plant is primarily induction motors with an inherently low power factor. Since the power company pays a substantial premium for power factor correction, it was a simple matter to determine that a capacitor was a paying investment.

POLE-TYPE CAPACITOR. This 45-kva, 4000-volt, 3-phase Westinghouse unit saves over $300 a year on the power bill for Bowman Dairy Co.

To provide for future plant expansion, the pole-mounted cabinet housing the present 4,000-volt, 3-phase, 60-cycle capacitor has space for an additional 15-kva. capacitor.

Glow Lamp Operating Data

Glow lamps produce light through the agency of electrically excited gases, neon and argon. Most of the lamps are neon and have the characteristic



"IRVINGTON" Varnished Fiberglas has proved its superiority in many motor installations such as this.

"IRVINGTON" VARNISHED FIBERGLAS

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"IRVINGTON" Varnished Fiberglas makes powerful motors smaller and lighter and tiny instruments more efficient and long-lived. It allows hundreds of types of electrical equipment to operate more efficiently, for more years, at higher temperatures, with greater resistance to attacking elements.

"IRVINGTON" Varnished Fiberglas is properly impregnated and coated with insulating varnish of highest grade to withstand the severe abuse which Fiberglas permits.

Here is glass cloth, woven from continuous fibers as manufactured by Owens-Corning Fiberglas Corporation; then thoroughly impregnated and coated by Irvington with high heat resisting black or clear insulating varnishes developed especially for this purpose.

To secure the benefits of highest insulation resistance, resistance to impact and abrasion, and the best balance in overall mechanical, electrical and chemical characteristics, the Fiberglas you use should be factory impregnated by Irvington's modern methods and with "IRVINGTON" High Heat Resisting Insulating Varnishes.

This superior product comes to you all ready to go in place, eliminating costly, time-consuming varnish impregnation and coating operations in your plant.

Detailed technical data and specifications for standard "IRVINGTON" Varnished Fiberglas cloths and tapes are yours for the asking. Write to Dept. 96. Data will gladly be furnished on the development and production of special combinations of Fiberglas cloth and varnish.

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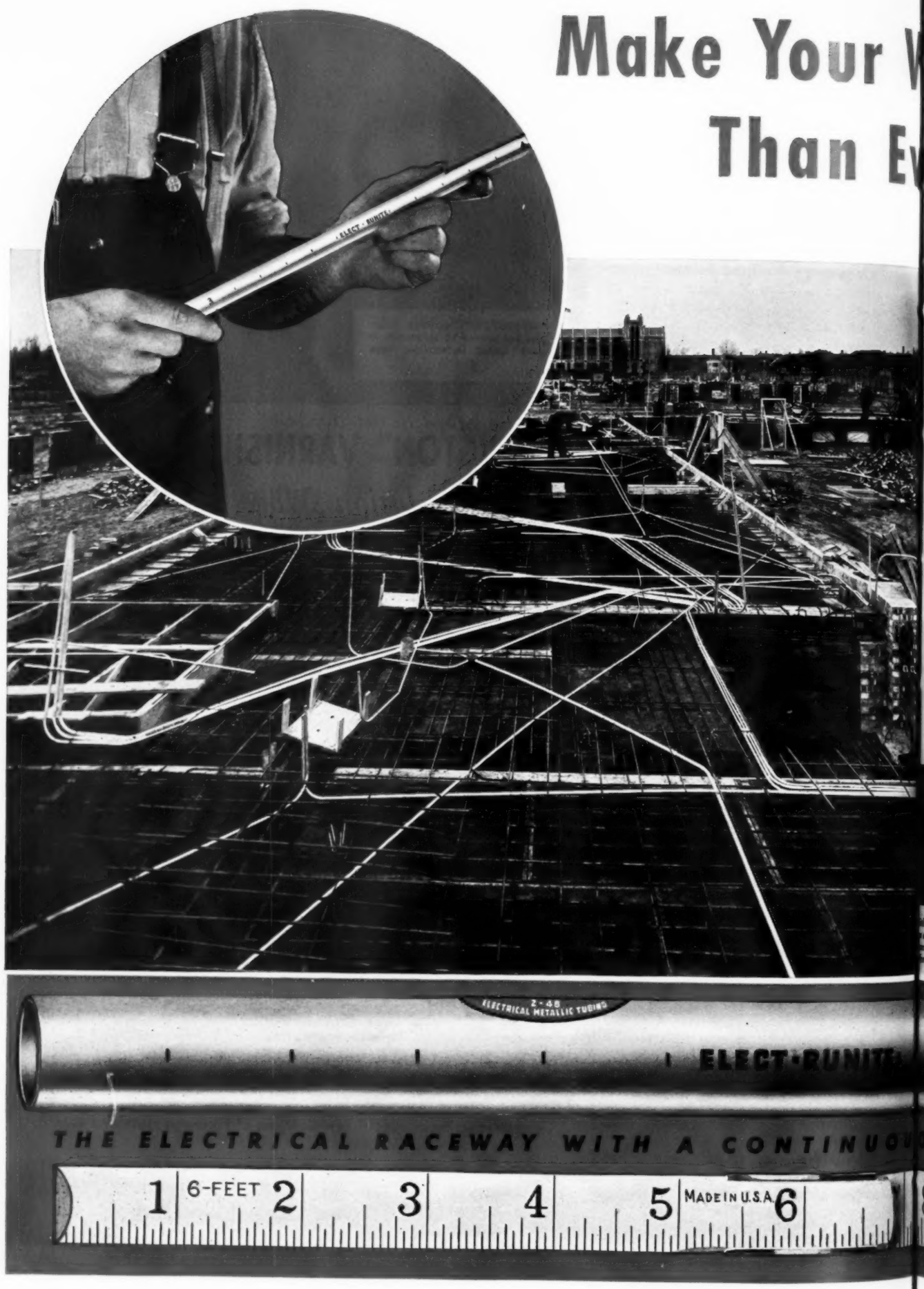
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"Inch-Marked" ELECTRUNITE STEELTUBES is the only raceway already marked off for you — and marked accurately — in feet and inches along every length. You can forget your foot-rule and save the bother of unfolding and folding it. Just use the tube as a rule — or count off the required distance on the tube and there's your mark for cutting or bending.

A hacksaw makes clean cuts easily and quickly. The new ELECTRUNITE Bender — with brief but ample instructions built into it — combined with "Inch-Marking" enables any good mechanic to make predetermined bends with greater ease and accuracy than ever before possible. And the bending tag on every bundle of tubing provides simple instructions for making bends that *always* fit.

Do you want to simplify your work — to make it easier — to eliminate guesswork and wasted material? Then try "Inch-Marked" ELECTRUNITE STEELTUBES on your next wiring job — exposed, concealed or in concrete. That's the way to learn for yourself why it is the easiest-to-use rigid steel raceway in the world. Steel and Tubes Division, Republic Steel Corporation. Cleveland, Ohio.

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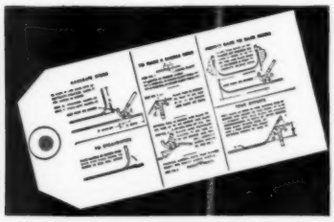

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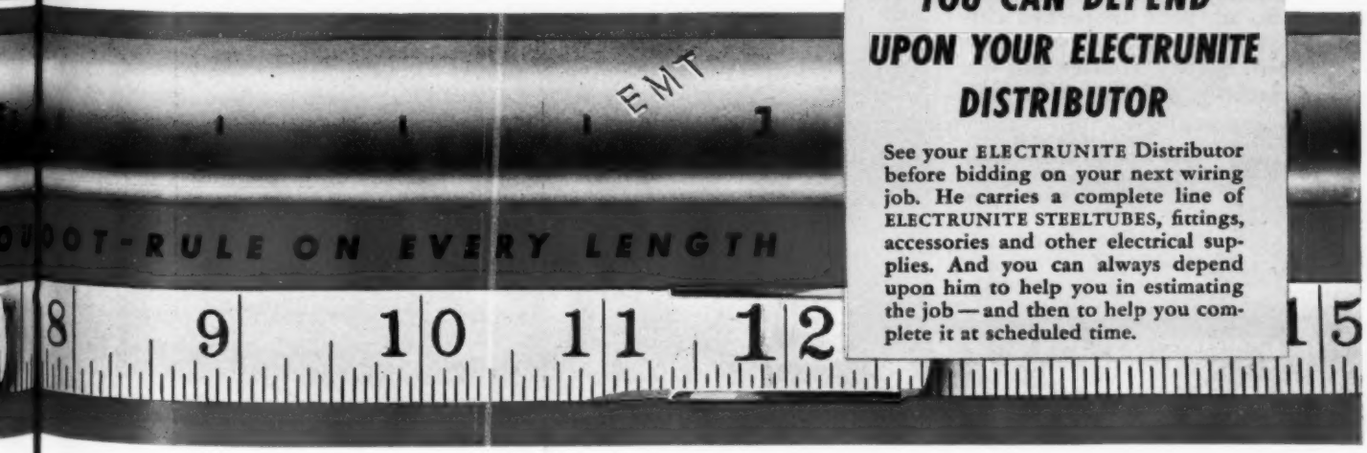

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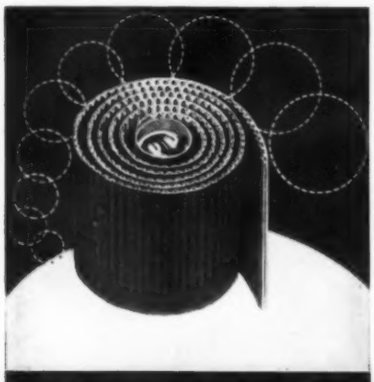

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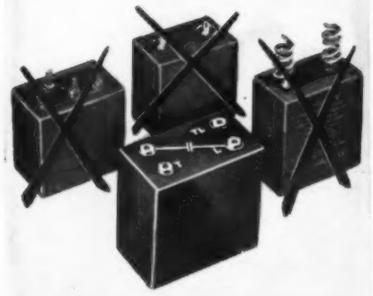

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orange-red color which distinguishes them from other surrounding lights.

Light source is two electrodes instead of a filament. When a lamp is energized by alternating current both electrodes glow, and when energized by direct current, only one (the negative) electrode glows. Light output is the same when the lamp is operated on either current.

Clear lamps are available in 1/25, $\frac{1}{10}$, $\frac{1}{4}$, $\frac{1}{2}$, 1, 2, $2\frac{1}{2}$ and 3-watt sizes with medium and candelabra screw base or, in the two smallest sizes, without base. Red-sprayed lamps are furnished in 2- and 3-watt sizes with medium screw base.

The lamps produce a negligible amount of heat, withstand both shock and vibration to an unusual degree, and may be subjected to voltage variations without greatly affecting either their life or light output. Average useful life is 2,000 hours.

Normal current and light output is obtained when the lamps are operated at voltages for which they are designed, that is, on circuits of 105 to 125 volts and 210 to 250 volts. No accessory devices are required for operation on commercial lighting circuits. Lamps will operate at reduced light output at voltages down to starting voltage which, for most lamps, is 60 to 65 volts a.c. or 85 to 90 volts d.c. If the lamps are to be operated continuously at higher voltages, such as 300, 400 or 500 volts, a series resistor should be used. The values of resistance and resistor wattage for the respective lamps and operating voltages can be obtained from the manufacturer of the lamps.

A-C Arc Welders Increase in Use

A significant trend during the past year was an increase in the use of a.c. arc welders, according to R. F. Wyer, Industrial Dept., General Electric Co. This swing to a.c. welding is probably most apparent in shops where heavy work is being done and where welds can be made horizontally or flat.

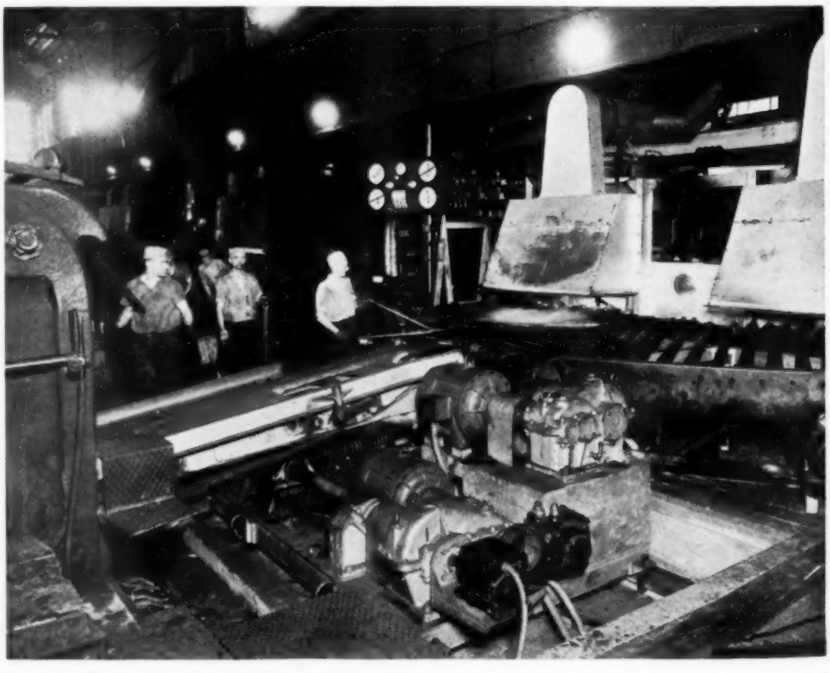
Many shops fabricating plate $\frac{1}{4}$-in. and up have standardized on a.c. arc welding, using only sufficient d.c. welders to handle special work. Industrial shops using welding as a production method have also turned to a.c. welders.

Increased interest in, and use of, atomic hydrogen welding was also noted. Tool shops and mold and die shops have specialized in atomic hydrogen welding. This process is particularly adaptable to work requiring rapid operation, the addition of relatively small amounts of material, and welding on materials for which suitable arc welding electrodes are not available.

Protecting Motors Against Overheating

High ambient temperatures are often encountered in steel mills due to the handling of heated metal. Some motors must operate through a duty cycle, which includes frequent starting and reversing, on roll-out tables and coilers.

Protection against overheating the motor winding, during the duty cycle as well as from excessive ambient temperature, can be provided. For such



***THERMOGUARD MOTORS** are used to drive the sheet catcher table in a steel mill (Westinghouse photo).*

protection a thermoguard is used. It is a temperature-registering device mounted directly on the motor winding, which registers condition within the motor. It can be connected in series with the control circuit of a magnetic contactor for starting and stopping.

Air Circulation for Summer Operation

Warm and humid days will soon be here. The number of employees and machines has been increased to step up production. Has provision been made for suitable air circulation? Here are a few points for consideration:

1. Does the ventilating system have adequate capacity and is it economical?
2. Have changes been made in processes or in layouts of departments where ventilating equipment was in operation?
3. What additional equipment will be needed, such as blowers, motors, control, ducts, and air filters?
4. Can cooling units be used with the existing system?
5. Are floor-mounted or pedestal type fans available to provide air circulation in an isolated department or a remote corner?

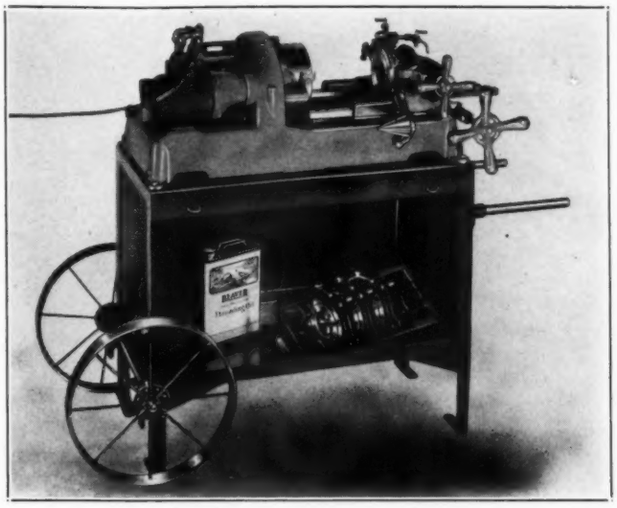
Cartridge Type Heating Units

Small heating units of the cartridge type have proven most satisfactory for heating steel dies in the manufacture of wall tile. They eliminate the practice of coating the dies with oil after three or four tiles have been run, to prevent ceramic sticking to die. Also, they contribute to improved plant operation by eliminating the hazard and difficulty of control when steam and combustible fuels are used.

The advantages of electric heat were experienced by a western tile plant. Cartridge heaters were inserted in both top and bottom parts of the dies. Wattage of the units being dependent on the size of the dies. A 100-watt, 230-volt unit was found to be satisfactory in each half of a 4¼ by 4¼-in. die.

At each molding press there are installed a three-contact outlet and ahead of it, a three-heat switch to control the input to the heaters. Leads from the heaters are connected to a three-pole plug. This arrangement permits changing dies without removing the heaters, by withdrawing or inserting the plug.

Although three heats are available, two are ordinarily used—200 watts on high and 50 watts on low. Medium provides for heating only one die and is not needed in all molding of tile.



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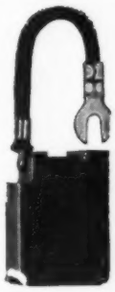

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Reader's QUIZ

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published, we pay $5.00.

MOTOR RANGE

QUESTION 1. Plans for a new industrial plant are being drawn. Power is to be purchased at 2300 volts. Some 150 motors ranging in size from 1 to 900 horse power are to be installed. The plant is to spread over an area of 20 acres. It is planned to use 440 volt motors in the smaller sizes and 2300 volt motors in the larger sizes. Just where should the dividing line be drawn? What should be the smallest 2300 volt motor? —L.P.C.

A. TO QUESTION 1. The transmission problem would have to be weighed against the cost of controls. If your motors were grouped in the ideal arrangement, I would have everything under 100 hp. on 440 volts and everything 100 hp. or over on 2300 volts. In the average usage, a motor of 100 hp. is subjected to very few shut-downs whereas a smaller motor may be stopped and started several times in an hour. It is much easier to service a 440 controller than it is a 2300 volt one.—G.W.P.

A. TO QUESTION 1. I would say that sizes above 75 hp. would be used on the 2300 volt power side. The reason is there must be some large runs of wire and pipe in such a large place and the cost of wiring should be a big factor. A motor at 100 hp. at 440 would draw full load about 123 amps., size wire would be No. 000 and conduit 2-in.

All 2300 v. motors and wiring must be protected from persons who are not in charge because of the high voltage. But this added protection would not cost very much in comparison with the saving in the above answer.—A.J.

A. TO QUESTION 1. I prefer motors that are mounted on ceilings and walls, and accessible to electricians only, to be of 2300 volts. This reduces transformers and copper is saved. The motors will be stronger on torque and quicker to gain regular speed. Where motors are smaller, driving individual machines and accessible to help, I would prefer them to be of the lower voltage, 440.

Motors of this class are not always properly looked after, and will have longer life on lower voltage as well as being much safer in case the grounding becomes impaired.—F.M.B.

A. TO QUESTION 1. We have 150 motors over an area of 20 acres. If this layout should consist of three or four buildings, then I would say 100 hp. would be the dividing line. Furthermore the speed of the motors would have some bearing on the subject. At 100 hp. 900 r.p.m. would also be a dividing line. Cost of distribution copper, figured against step down transformers would be a large factor, also.

If the motors are grouped within a radius of 1000 feet of a distribution point, then the dividing line could be raised to 200 hp. at 600 r.p.m. As an example, a 100 hp. motor at 440 volts, 3 phase, 1500 feet from the center of distribution would mean around 2000 lbs. of wire, whereas a similar motor at 2200 volts would be around 350 lbs. of wire. The cost of conduit and labor would also figure against a higher insulated motor.—F.W.S.

A. TO QUESTION 1. All motors 100 horse power or less should be 440 volt motors. This dividing line is found by taking into consideration the minimum wire sizes that are practical in any large motor winding. A 100 horse power—2300 volt motor would be wound with about No. 12 wire which in my opinion is too small for any drive where any considerable vibration is present.—*L.A.H.*

LOCATING CONTROL

QUESTION 2. The electrical engineer finds it possible to include any reasonable provisions in the plans for a new plant. He decides to locate all motor controllers in special rooms at strategic points. He provides for disconnecting switches immediately above each controller. The control rooms will be accessible to electricians only. Naturally magnetic or completely automatic controllers must be used. Is the extra cost of such an installation justified?—L.P.C.

A. TO QUESTION 2. The extra cost would be justified only in certain cases such as hazardous locations where explosion-proof or vapor-proof devices are required. For locations like tool and die-making equipment or press rooms it is cheaper to install switches, starters, push buttons and other devices on the machine, so when you move the machine, you move everything with it.—J.P.J.

A. TO QUESTION 2. The electrical engineer should take into consideration, safety to operators, set-up men, and repairmen. Disconnecting means shall be located within sight of the operator, or by remote control stations that can be locked in off position. The latter is not complete protection in case of a contactor "freezing" and when two fuses of a three phase system blow.

Mount the electrical equipment directly upon the machine it controls. In case the equipment is large, mount it upon a rack as one unit and place close by. By this method, machines can be moved, plants can be rearranged to accommodate expansion requirements, and the wiring expense can be held to a minimum.—D.S.

A. TO QUESTION 2. I tried this 20 years ago. From an electrical man's point of view, this is ideal in respect to cleanliness and possibility of tampering, but it means that for complete safety to machine repair men, it is necessary to call on electricians to pull

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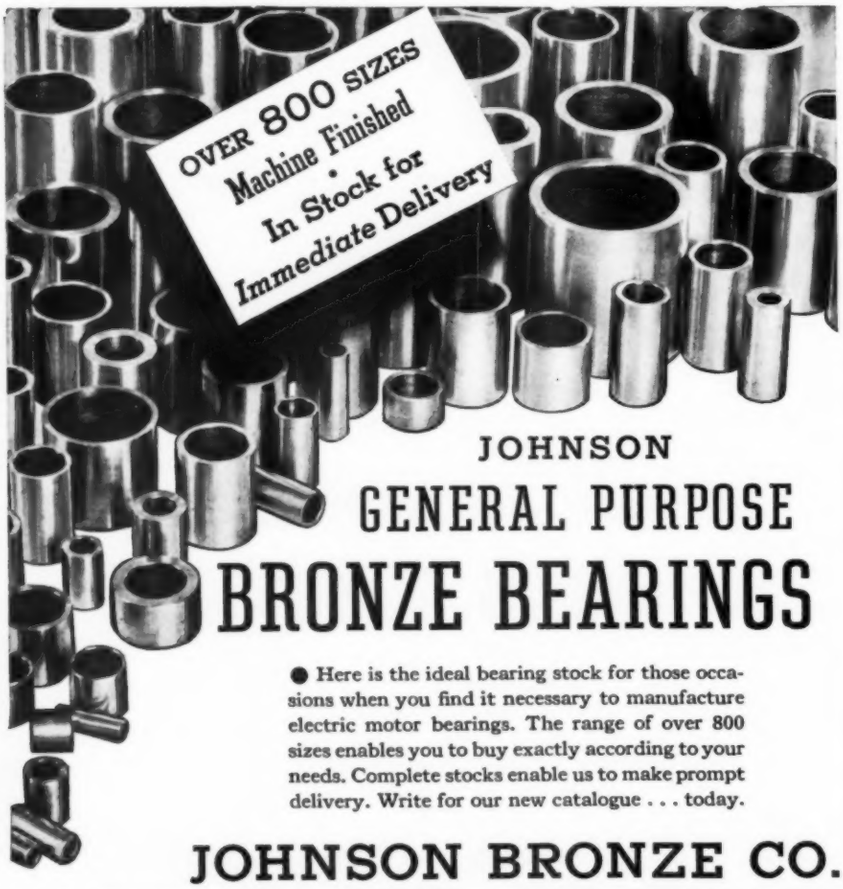

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Reader's QUIZ

[FROM PAGE 66]

the line. This is all right if an electrician can be located. Then it also means that when repairs are completed, the electrician has to unlock the control room and throw in the switch again. Maybe the electrician has gone home, and has to be called back, or he has to wait around until late.

This causes the repair men to start turning these repairs without pulling line switches and what can be expected? Several bad accidents, including several deaths, resulted.

The Safety Department, insisted that the line switch be placed near, or on all machines. And that the repair men, before starting machine repairs, first pull the switch and place his padlock on it.

It meant that if starting equipment was left in isolated rooms, all these lines from the panel had to run to machines and back again to starters and compensators. Also an oven explosion in our No. 1 plant once caused all our magnetic starters in this plant to close, starting every machine that did not have the line pulled. I have since gone back to the original method of placing starting equipment just as close to each machine as possible—A.J.F.

A. TO QUESTION 2. A controller should be placed near and in sight of its motor. The operator can then see that all is clear about the motor and its drive. The operator should watch the pick-up of the motor and listen for any strange sounds during the accelerating period. Due to the starting current being much greater than the full load current, the distance between controller and motor should be as short as possible to save copper, and insure the motor its proper voltage at the terminals. Long lines from controller to motor also affect the quick pick-up of the motor and the "time lag" in its fuses. A "stop" button should always be placed handy to the motor.—F.M.B.

BRONZE OR SILVER?

Q *UESTION 3. The rotor bars of a squirrel cage motor are breaking loose from the end rings. Should bronze welding or silver solder be used in making repairs? And why?—L.P.C.*

A. TO QUESTION 3. In some of the older types of motors where the collector rings are not a

New PAINE BRAIDED FIBER Woodscrew Anchor

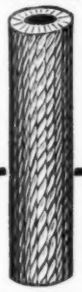

Fig. 955

11 Different Diameters to Fit Woodscrews from No. 5 to 5/8 inch Lag in all Popular Lengths.

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2. It's chemically treated to withstand temperature changes and to protect against moisture.
3. It can be cut to the exact size needed with a pair of pliers without fracturing the material.
4. It's easily and quickly installed without a setting tool.
5. It's equally effective in lath and plaster, marble, tile, slate and fragile composition materials in new installations and in bushing existing screw holes.

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part of the lamination bonding, I would suggest brazing where the effect of heat would not warp the laminations. In any rotor where the end rings are used to hold the lamination under compression, I would use silver solder because less heat is required in the process of soldering. If properly soldered by an experienced welder, the bond will be maximum in strength and electrical conductivity.—D.S.

A. TO QUESTION 3. When the rotor begins to break loose from the end rings, trouble arises which will never be remedied by brazing the loose ones only. Unless all the bars make perfect contact with the end rings, the motor will not develop its rated horse power. To repair this type of rotor, file the bars and rings clean, and then silver solder each bar to the rings. When this is done, your rotor trouble is over.—L.A.H.

A. TO QUESTION 3. If rotor bars are kept full size to the end rings and secured by machine screws coppered, threaded through the rings with lock-nut and spring washer, your troubles will be over. Where contact ends of bars are reduced in size or where they may be in multiple, the heavy starting current causes expansion much quicker than in the end rings, and in time this hinge like strain will cause fracture.

I have had trouble of this nature in one 100 hp. and several 4 hp. motors where bars were in multiple or reduced in size at the ends. The most important thing about these points is to have them mechanically right. The soldering is in my opinion a secondary consideration.—F.M.B.

A. TO QUESTION 3. On most small motors, the bars are soldered to the rings after the bars are posted through a hole in the ring and hammered over. Then you could use silver solder to bond and make a good contact. This solder takes more heat than regular solder but takes less heat than bronzing.

But on larger motors most bars are brazed and make a stronger joint. Pass the current through the contact resistance to get the heat at the main point and not heat up the rest of the rotor. —A.J.

A. TO QUESTION 3. Silver solder is the best method or use Sil Fos at a lower cost than silver. If the job has been done with a regular lead and tin composition previously, it will be impossible to ever do a good job with bronze welding.

First Aid

GORILLA GRIP

"First-Aid" Stock Set of various sizes and shapes of Gorilla Grip Connectors always ready for an emergency. 125 Combinations possible by use of various Terminal Units and Reducing Sleeves. Built to Meet your Needs. Write for descriptive Book.

National Electric
PRODUCTS CORPORATION
1000 FULTON BUILDING, PITTSBURGH, PA.

TIREX
helps your Safety Record

All stock sizes of TIREX Cords and Cables now have a permanent marking molded onto the "selenium rubber armor." These markings not only identify the cord or cable as Simplex - TIREX but also show the size, number of conductors, type and voltage rating of the cable.

Here is a further example of the quality and thought put into the construction of all TIREX Cords and Cables. The seine twine reinforcement, the "selenium rubber armor" and now the new complete markings are all evidence that TIREX is made for greater safety and efficiency. The stock sizes of TIREX are given in complete detail in the latest edition of the TIREX catalog. We will be glad to send you one upon request.

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QUIET Please!

Do you disturb building occupants when you drill holes?

For work in occupied buildings and offices where noise is objectionable—frequently requiring after-hour work—the Carboloy Masonry Drill permits work at *any* time without disturbing occupants. It's QUIET—eliminates all noisy hand chiseling of holes.

Saves time too! Drills holes in concrete, tile, porcelain, brick, etc. 50%—75% faster! Lasts longer! Stays sharp for long intervals of continuous use because it's tipped with Carboloy cemented carbide—a metal approaching the diamond itself in hardness. And here's another valuable feature: Carboloy Drills won't splinter fragile work. Drills clean, accurate holes.

Use in any rotary drill. Send for leaflet.

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11135 E. 8 Mile St., Detroit
Send free leaflet on Carboloy Masonry Drill-Points, for drilling 75% faster

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MASONRY DRILL-POINTS

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INSTALL **TRICO** REG. U.S. PAT. OFF.

RENEWABLE FUSES
With the famous Powder-Packed Element

KLIPLOK CLAMPS
Lock fuses and clips together

KANTARK FUSES
With genuine fibre tubes (not paper)

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The color tells the size

FUSE PULLERS
Pull and replace fuses safely

OILERS
Glass and Unbreakable types for every application. Stops guesswork - bearing failures- waste- idle machinery, etc.

WRITE FOR FOLDER No. 300

TRICO FUSE MFG. CO., Milwaukee, Wis.
In Canada: IRVING SMITH LIMITED, Montreal

Reader's QUIZ

[FROM PAGE 67]

The higher temperature may cause distortion of end rings or laminations.

A very good job can be done after a little practice by the average motor repair man with silver solder or Sil Fos. Bronze welding frequently leaves very crumbly joints which soon break away again.—J.F.M.

Can You ANSWER *these* QUESTIONS?

QUESTION A—In our steel mill we have trouble locating grounds on our 440-volt feeder system. We have five feeders from a common transformer bank. They supply 100 or more branch circuits. We check the system each day with a test light and when a ground is indicated must test each one of the branch circuits in turn until the ground is located. We cannot kill the feeders separately at the sub-station without interfering with production. Can someone suggest a better method?—J.W.B.

QUESTION B—I have a 100 hp. unity power factor motor, on a compressor, that all of a sudden requires 5 amperes more d.c. excitation to bring it up to unity power factor. Rings on motor are clean and brushes are riding properly. Exciter is O.K. What can be the trouble?—N.H.T.

QUESTION C—We are planning to install four large exhaust fans, probably 36 inch diameters, to be mounted in penthouses, with automatic shutters. I have in mind 3-speed motors. This will permit varying the volume of exhausted air for different seasons. If this type of motor is installed will this interfere with adding later an automatic thermostat control device for one or more of these exhaust fan units?—F.J.S.

QUESTION D—We have 56 motors totalling In addition, we have ten lighting transformers ranging from five to ten kva.

Which would be cheaper or more practical, to purchase proper size motors to replace the large ones now in service or install capacitors?—R.E.G.

577 hp. ranging from fractional to 25 hp. synchronous. We have ample copper capacity but we believe we could improve our power factor.

We have eliminated line shafts and all machines are now individually driven. It was necessary to use the line shaft motors for individual drives and these are larger than necessary and have poor power factor.

PLEASE SEND IN YOUR ANSWERS BY MAY 1

"OLD RELIABLE" at the Lighting Controls

H & H "8601" Tumbler Switch

Complete Line

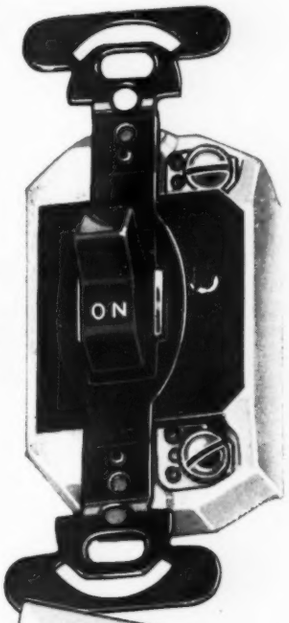
Specification Grade
"T"-rated for Type
C Lamp Loads

No. 8601 — Single-pole
No. 8602 — Double-pole
No. 8603 — Three-way
No. 8604 — Four-way

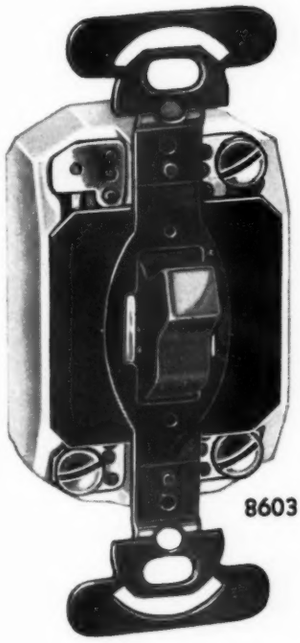
Shallow 1" porcelain base.

Standard brown Bakelite or white Ivorylite handle.

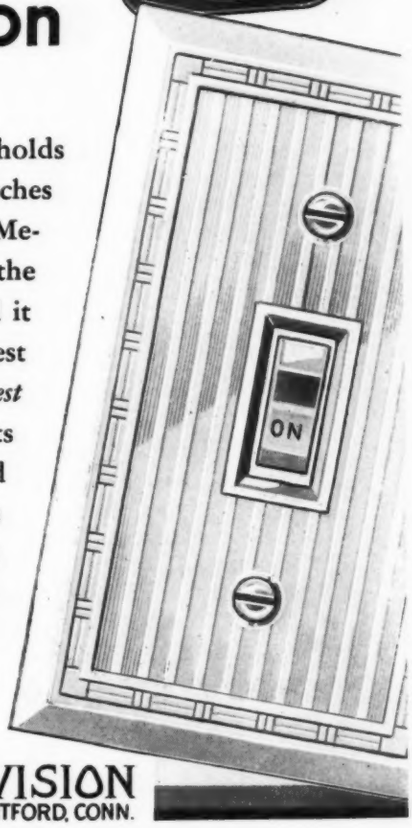
For IVORYLITE, add "I" to Catalog numbers and specify H & H Ivorylite Plates (in standard Uniline design).



Rugged Dependability for more than a generation



"OLD RELIABLE" — Number 8601 — holds *Number* 1 *rank* among Tumbler Switches with veteran Contractors who KNOW. Mechanically and electrically, so *right* from the start that no later switch has surpassed it for lasting service. As new as the newest in smooth operation; *newer than the newest* in long-term VALUE... No replacements are ahead of you when you put "Old Reliable" at the lighting controls. By its balanced action and rugged parts, it *stays* on your jobs; keeps them functioning smoothly. Its quality supports good work; identifies good wiring.



HART & HEGEMAN DIVISION
THE ARROW-HART & HEGEMAN ELECTRIC CO. HARTFORD, CONN.

Saves $8,000 ...gets more fluorescent light!

... with IVANHOE "50 FOOT CANDLER" RLM *Continuous Wireway* FLUORESCENT LIGHTING SYSTEM

Well-known manufacturer* receives this profitable *double-benefit!*

Specifications for bids on 2,000 individual fluorescent units had already been issued. Then engineers on this important new plant* discovered their lighting job could be handled more efficiently and economically with IVANHOE "50 FOOT CANDLERS". Very next day entire electrical work was done over—new estimates made up. These called for a minimum of 30 foot candles *maintained*—5 *foot candles more* than originally planned. They got this greater illumination and along with it *a net saving of $8,000!*

WHEN THE CUSTOMER SAVES MONEY ... YOU MAKE MONEY!

IVANHOE "50 FOOT CANDLER" saves money for your customers because it is *not* a lighting fixture but a *lighting system*—the first RLM *Continuous Wireway* Fluorescent Lighting *System* providing new higher levels of illumination at economical cost. No fluorescent equipment today duplicates it. It gives you an *exclusive* opportunity to get in on jobs at "the planning stage"—to handle *more* jobs and *bigger* jobs—to make more money. WRITE TODAY for new "50 FOOT CANDLER" Bulletin 1C, and write *anytime* for Miller's cooperation on any job, large or small.

IVANHOE "50 FOOT CANDLER" offers...

Higher Illumination . . . 30 to 50% Lower Installation Costs . . . Easier, Faster Installation . . . Uniform Light Distribution...Clean-cut, Modern Appearance... Simplified Maintenance... Allowance for Future Lighting Needs.

THE IVANHOE MARK OF A COMPLETE LIGHTING SERVICE

**Name and full details released in confidence on request.*

THE MILLER COMPANY
MERIDEN, CONN.
Pioneers in Good Lighting Since 1844

and in 2½-in., 4-in. and 6-in. sizes. Accessories include hangers, reducing fittings, telescoping fittings, junction boxes, panel fitting collars, pull boxes, elbows, nipples and cutouts.

A modification of this duct is used as "cable troughs" for group mounting of meters, motor control and other equipment. For extensive group mounting of equipment, a similar type of duct is furnished with busbars drilled for frequent tap-off circuits. These troughs generally have screw covers.

Application—This type of duct is used for running feeders, branch circuits and groups of conductors where it is desired to have complete access to the conductors at all points.

Advantages—This system provides many of the advantages of the feeder and distribution busbar ducts, modified of course by the fact that there are no busbars and conventional cable must be used. It does permit a considerable reduction in the number of conduit runs in a large installation, however. It gives a much greater degree of flexibility for additions and changes than the conventional conduit system. It does not have the extreme flexibility of the busbar system.

Installation Technique—There is no particular technique involved in installing this duct. It is simply a matter of bolting the duct sections, fittings and hangers together and supporting the duct. Once the system is complete the branch circuit conduits are installed, the wire pulled, cables laid in the duct, connections made and the duct cover snapped shut.

Selecting the System

There are many different wiring systems in use today. Each has its merits and should be considered when selecting an electrical distribution system. Many factors affect the design of a system, such as voltage, phase characteristics, production schedules and methods, present and future load, machinery rearrangement, flexibility, accessibility, adequacy, atmospheric conditions and many others. One distribution system may work where another will not. One may offer more advantages than another. All these items should be carefully studied before a choice is made. There is a vast market for this type of distribution today and the alert electrical man will see it and cash in on it.

Choose
G-E WHITE
FOR JOBS TODAY
DURABLE
UNIFORM
EASY TO BEND
ACCURATE THREADS
PROPER FITTINGS
Wiring systems in the buildings you wire now will be worked hard. Therefore, it is to your advantage to use G-E White Rigid Conduit. You'll have more satisfied customers and fewer service calls to make.
G-E White high quality Rigid Conduit gives lasting protection to wiring—helps to prevent electrical breakdowns. It is hot-dipped galvanized and Glyptal coated inside and out. It is resistant to heat, flame, cold, moisture, gas, acids, alkalies and mechanical injury.
Moreover, G-E White is easy to install. It bends easily, has accurate threads, and doesn't split at seams even on severe bends. Wire can be pulled quickly.
For further information see the nearest G-E Merchandise Distributor or mail the coupon for a G-E Conduit Products catalog.
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GENERAL ELECTRIC

THE NEW WHEELER
"DAY-LUX"
FLUORESCENT LUMINAIRES
FOR LIGHTING

Offices, Stores, Hotels,
Clubs, Restaurants,
Theatres, Public Buildings, etc.

Here is a new line of distinctive, beautifully designed Fluorescent luminaires made especially for general illumination purposes in commercial locations.

These fixtures furnish an abundant quantity of the soft, cool daylight illumination which makes seeing easy and working conditions ideal.

"DAY-LUX" Luminaires, which utilize 40-watt lamps, are available in two- or four-lamp construction.

All fixtures are supplied complete with white lamp holders, high power factor Tulamp ballast equipment, and removable and renewable separate starter switches located on the top of the units.

Reflectors are constructed of white enameled steel. Decorative end caps and canopy finished a beautiful crackled aluminum.

As illustrated, fixtures can be supplied with panels of frosted glass, or without glass.

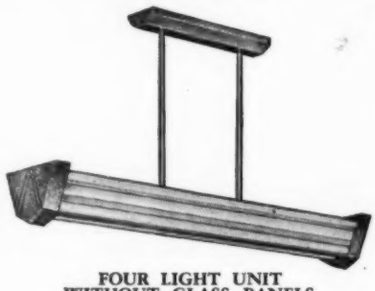
All units are furnished with ballasts for 110-125 volts, 60 cycle A.C. operation.

Length of stems: 24" standard.

FOR MOUNTING CLOSE TO THE SURFACE

If desired for surface mounting, fixtures will be furnished with 6" stems.

FOUR LIGHT UNIT WITH GLASS PANELS



FOUR LIGHT UNIT WITHOUT GLASS PANELS

TWO LIGHT UNIT WITH GLASS PANELS

TWO LIGHT UNIT WITHOUT GLASS PANELS

For complete data write for New Bulletin No. 65-A

Distributed Exclusively Through Electrical Wholesalers

WHEELER REFLECTOR COMPANY
275 CONGRESS ST., BOSTON, MASS.
NEW YORK ATLANTA CLEVELAND

Some Data On A Baseball Job

[FROM PAGE 19]

Each transformer was provided with a 5 per cent voltage tap which gave a resultant secondary voltage of 252/126 volts. Figuring approximately a 4 per cent voltage drop, due to the secondary wire distribution system, the resultant voltage was about 121 volts, operating at approximately 10 per cent overvoltage. This is standard practice in sports lighting installations, because while operating the lamps at 10 per cent overvoltage results in a 16 per cent increased wattage consumption, it gives a 35 per cent increase in light output.

It can readily be seen that the increase in output is much greater than the increase in wattage consumption. Operating the lamps at 10 per cent overvoltage will shorten the life of the lamps but as they are not used to any large extent during a year's time, it is found that the lamps will last for approximately two years.

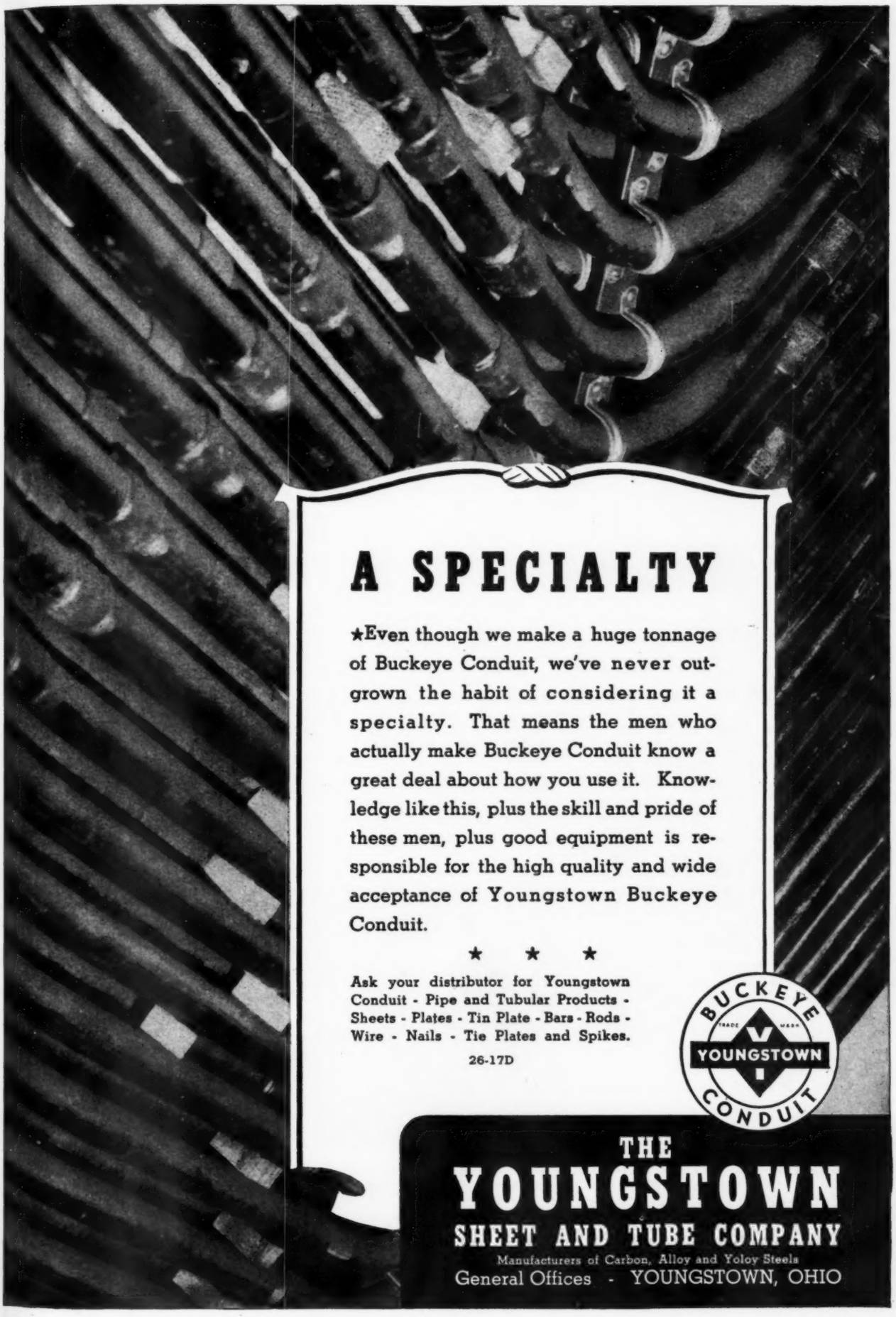
The whole system is controlled by a General Electric FP7 controller mounted on the incoming lines. The controller is housed in a specially constructed room back of the scoreboard to eliminate tampering.

Aiming Floodlights

The final step in the completion of the installation was the adjustment of the floodlights. To do this, the primary cutouts on all the transformers but one were disconnected so that the lights on only two poles were burning. All of the lights on these poles were turned up so that none of them shone on the field. Then one at a time they were turned down and adjusted so that they would direct their light on the proper area of the field. The resetting ring, which is provided with each floodlight, was set so that the floodlight could be returned to its adjusted position and the floodlight was turned up again.

This was done with each floodlight on all of the poles. When they had all been adjusted to the proper position, according to a predetermined aiming chart all of the floodlights were turned down.

The job was started on April 22, and the construction work was finished on May 14. The floodlights were adjusted on the night of May 15. The first game under lights took place on May 29. The total cost of the entire installation, including lamps, poles, foundations, wiring, underwriters' fee and city license was $10,000.



A SPECIALTY

★Even though we make a huge tonnage of Buckeye Conduit, we've never outgrown the habit of considering it a specialty. That means the men who actually make Buckeye Conduit know a great deal about how you use it. Knowledge like this, plus the skill and pride of these men, plus good equipment is responsible for the high quality and wide acceptance of Youngstown Buckeye Conduit.

★ ★ ★

Ask your distributor for Youngstown Conduit - Pipe and Tubular Products - Sheets - Plates - Tin Plate - Bars - Rods - Wire - Nails - Tie Plates and Spikes.

26-17D

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THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steels

General Offices - YOUNGSTOWN, OHIO

Estimating

OPEN WIRE SERVICE FOR LOADING PLATFORM

A mid-west electrical contractor was recently called on to install an overhead open wiring system for power and lighting along a 640-foot ice loading platform in a railroad yard. The platform had two motor houses, one at the north end and the other 500-ft. south of it. A series of crossarms, mounted at box car height on vertical supports at 80-ft. centers extend over the tracks on either side of the entire platform.

The electrical work consisted of installing a 440-volt, three-phase service to the north motor house and extending it on crossarms to the south motor house; extending open wiring lighting circuits with weatherproof pigtail sockets every 20-ft., fed from transformers and multibreaker panels in the motor houses; and extending, to three control stations on the vertical crossarm supports, circuits for operation of conveyor motors.

Wire sizes were No. 8 for the power lines between the motor houses and No. 10 for all other circuits. House brackets were used for dead ending and lag type single insulators for intermediate crossarms. Circuits not on the crossarms were in conduit with service heads for tapping to the open wiring. The installation was made during extremely cold weather.

An accurate check on material and labor was kept for future reference and revealed the following data:

MATERIAL INSTALLED. This covers only the open wiring part of the work.

1500 ft.—No. 8 wire.
1200 ft.—No. 10 wire
6—Three-wire house brackets
6—Two-wire house brackets
72—Lag type single insulators
56—Weatherproof pigtail sockets

LABOR BREAKDOWN

MOUNTING DEAD END BRACKETS—includes drilling crossarms and mounting the six 3-wire and six 2-wire house brackets. Work was done while crossarms were on ground prior to mounting.
Total time ..... 5.0 m. h.
Average time per bracket..... 0.42 m. h.

MOUNTING INSULATORS—including mounting the 72 lag screw insulators on the crossarms while they were still on the ground.
Total time ..... 9.0 m. h.
Average time per insulator..... 0.125 m. h.

CUTTING CABLE—includes unreeling, measuring and cutting to length the 1500 feet of No. 8 and 1200 feet of No. 10 wire, which was laid on the ground alongside the platform.
Total time ..... 3.0 m. h.
Average time per 100 feet..... 0.11 m. h.

INSTALLING SOCKETS—includes skinning the No. 10 weatherproof wire and pigtails for the 56 sockets, splicing, soldering, taping and compounding all connections.
Total time ..... 22.40 m. h.
Average time per socket..... 0.40 m. h.

STRINGING WIRE—includes stringing the wire, dead ending it and binding it at each insulator. Data based on a single-wire, 80-ft. span including tying at one insulator.
Time per span..... 0.33 m. h.

The general conduit work on the job is not included in the above units.

Data from Continental Electrical Construction Co., Chicago, Ill.

***SYSTEM DESIGN** is a large part of Joseph W. Kenney's job as engineer and estimator for the James Wilkinson Co., Boston, Mass., one of the first established electrical contracting firms in the east. Joe believes that careful engineering will bring in profits in spite of the consistent pencil sharpening that is necessary under present competitive practices.*

RELOCATING A BUS DUCT SYSTEM

A large industrial plant in New Jersey found that increased production demands necessitated the relocation of a large machine shop to make room for additional production machinery. Since this machinery was automatic and of an exceptionally complicated type, the operation of the machine shop was vital for making repairs and new parts. So the work of making the change had to be scheduled to require the least possible shut down.

The existing electrical system consisted of a three phase, four-wire, 120/208 volt Flex-A-Power plug-in-type of bus distribution, with conduit drops from the bus plug-in outlets to the combination disconnect switch and starters on the machines. Individual machine lights on adjustable brackets were clamped to the conduit drops and connected to the circuit through three-wire receptacles inserted in the line. Approximately 27 machines ranging from ½ hp. to 7½ hp. were fed from 100 feet of this bus duct.

Preliminary surveys were made to determine the new location of the machines and source of power so that as much work as possible could be done before the machines were moved. The mounting height of the duct in the new location was the same as that in the existing shop, thus permitting the salvaging of the elbows and vertical sections of the conduit drops. The only new conduit to be cut was for the horizontal sections from the machines to the duct line. The main disconnect switch and duct feeder conduit were permanently installed and terminated at the location of the new duct line. Hangers were fabricated and installed ready to receive the relocated duct. All was then ready for the actual changeover which took place during a week end shutdown of the plant.

The working schedule that was closely followed included the tagging of each machine, fused plug, conduit drop and proper motor rotation so there would be no confusion when the machines were moved to their new positions and the connections reinstalled. Then a crew of four men worked on the dismantling operation, two disconnecting the conduit drops at the duct end while two disconnected them at the machine end. After the machines were moved the four men took down the duct line and moved all the electrical equipment to the new location, about 800 feet away, for reinstallation.

The following is the recorded labor breakdown for the entire changeover:

DISCONNECTING CONDUIT DROPS—includes disconnecting the 27 machine conduit drops at both the machine and duct ends.

Life's Brightest Moment : : : : BY WEBSTER

HERE Y'ARE! A GREAT BIG LOAD OF FAN PROMOTION FREE!
A FAN DEALER ----- WHO MIGHT BE YOU --- RECEIVES A PRESENT OF THE SWELLEST G-E SALES HELPS EVER
WEBSTER

You'll Get This Powerful Promotion Backing When You Sell the Fans with the Big Sales Pull—*G-E*

Size up this set-up on G-E Fans. Consider the most complete line of fans in all America. Consider their quality reputation. Tops, and the whole world knows it! Consider the whopping sales of G-E Fans every year. Consider the constant advertising that blankets the country with G-E prestige. Especially consider this powerful free promotion that outstrips any you've ever seen in the fan business.

1. You get a 10-color action *Window Display* that's a traffic-stopping smash. A display that holds, convinces, sells.
2. You get *Direct Mail Pieces* that work for you in homes, stores, offices. Every one a star fan salesman!
3. You get handsome *Catalogs* of the new G-E Fan models, crammed with illustrations and sales-building facts.
4. You get a striking campaign of *Newspaper Ad Mats* for local use when your market is "hot."
5. You get powerful *Newspaper Advertising* in over 175 key cities—run when you need its help—in local hot weather.

Remember, you get this promotion all *free!* On top of a sweet proposition to build dealer profit. Hear the details from your G-E distributor salesman. Go places with G-E Fans next summer!

Fan Sales Section, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

GENERAL ELECTRIC

THERE ISN'T A PLANT IN YOUR TERRITORY
that doesn't NEED some PLUGMOLD

for
Assembly Benches
Test Racks
Work Lights
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SELL TIME SAVINGS... EASY INSTALLATION... QUICK ACTION to busy defense industries

PLUGMOLD is easily and quickly installed . . on the surface . . . with fittings that connect to existing wiring or other Wiremold Systems. In most cases normal work need not be interrupted during installation.

PLUGMOLD *is different*

There is no other system exactly like PLUGMOLD, with its important advantages of plug-in-anywhere convenience, COMPLETE flexibility in number and location of outlets . . . ability to ADD or RELOCATE outlets at will, or to replace any outlet that may fail in service without replacing the entire outlet strip.

Sell these great PLUGMOLD advantages NOW. Meet the need for "MORE OUTLETS for MORE OUTPUT" that faces practically every manufacturing establishment in your territory . . a wide open business-building opportunity for smart contractors everywhere.

Write or wire for PLUGMOLD literature and samples.

THE WIREMOLD COMPANY, HARTFORD, CONN.

PLUGMOLD
CARRIES CURRENT TO WORK

"Plugmold" Multi-Outlet Assembly | Wiremold Fluorescent Lighting Equipment | "Pancake" Wiremold Overfloor Wiring System | Wiremold Surface Raceway Wiring Systems

Estimating

[FROM PAGE 74]

Four men were required, two working on the duct end and two on the machine end simultaneously.
Total time..... 8.0 m. h.
Average time per machine..... 0.296 m. h.

DISMANTLING THE BUS DUCT—includes disconnecting the main feeder, removing the main disconnect switch, end feed-in box, conduit, cable, hangers and taking down ten 10-ft. sections of the bus duct. Four men were required for this work.
Total time..... 12.0 m. h.
Average time per 10-ft. section, including conduit feeder..... 1.2 m. h.

MOVING EQUIPMENT—includes moving all the dismantled electrical equipment to the new location approximately 800 feet away. Four men required.
Total time..... 4.0 m. h.

REINSTALLING MAIN FEEDER—includes the installation of the 200 ampere, 3 pole, 4-wire main disconnect switch and 15 feet of 2½-inch conduit with four No. 4/0 rubber covered wires to the new location of the bus duct line. Two men were required.
Total time..... 8.0 m. h.

REINSTALLING THE BUS DUCT—includes the mounting of the 100 feet of bus duct on the hangers previously installed. Four men were required.
Total time, including the mounting of the hangers..... 30.0 m. h.
Total time for mounting duct alone..... 12.0 m. h.
Average time per 10-ft. section of duct, including hangers..... 3.0 m. h.
Average time per 10-ft. section of duct only..... 1.2 m. h.

MISCELLANEOUS WORK—includes identifying and placing vertical conduit drops by the respective machines and connecting the main feeder and tightening the section bolts of the duct line. Two men were required.
Total time for placing conduit drops..... 2.0 m. h.
Total time for connecting mains and tightening bolts..... 2.0 m. h.

MACHINE CONNECTIONS—includes cutting and installing the horizontal conduit sections from the machines to the duct, mounting the fused switch plugs on the duct, pulling new wire to the machines and making connections at the duct and machine ends. Six men were required.
Total time..... 27.0 m. h.
Average time per machine..... 1.0 m. h.

ENTIRE CHANGEOVER—includes the time for dismantling the original system and reinstalling it in the new location.
Total time..... 93.0 m. h.

The above labor units include no supervisory labor other than that of a working foreman. An interesting feature of this change was that only two per cent of the material cost of the original installation was not salvable. And this consisted mainly of the wire to the machines and the horizontal conduit sections from the machine drops to the duct line.

Data from E. J. White Company, Newark, N. J.

Certified★ FLEUR-O-LIERS

KEY TO THE BEST IN FLUORESCENT!
KEY TO NEW LIGHTING PROFITS!

FLEUR-O-LIER
The Manufacturer guarantees by affixing this label that this Fluorescent Luminaire is a duplicate of samples found by periodic examination to comply with the minimum requirements as set up in the
"SPECIFICATIONS FOR LUMINAIRES, FITTINGS AND AUXILIARIES FOR FLUORESCENT LAMPS"
which are sponsored by the Manufacturers of Mazda Lamps.
ELECTRICAL TESTING LABORATORIES
NEW YORK, N. Y.
ETL
A Copy of This Certificate Should
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THIS CERTIFICATION IS CONTINGENT UPON EMPLOYMENT OF CERTIFIED AUXILIARIES OF OVER 85% POWER FACTOR

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2. Auxiliary control equipment (ballasts and starters) in FLEUR-O-LIERS is *certified*—which assures balanced, coordinated operation of the complete unit.

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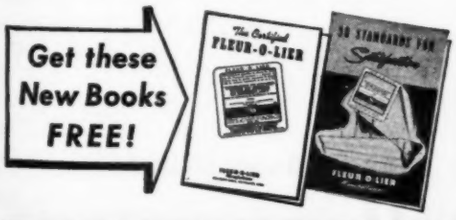
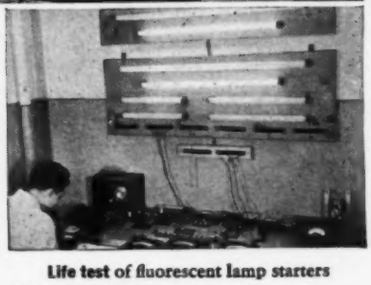
Electrical Testing Laboratories certify *that FLEUR-O-LIERS have met with 5 specifications for Lighting Effectiveness—6 for Electrical Safety—18 for Mechanical Soundness—14 for Electrical Excellence—7 for Auxiliary Performance . . . as set up by MAZDA Lamp Manufacturers. All Certified★ FLEUR-O-LIERS must be equipped with auxiliaries (ballasts and starters) certified by E. T. L. When you buy, check with your lighting company on how to install FLEUR-O-LIERS to properly meet your needs.*



Certified★ FLEUR-O-LIERS in these stores means easier seeing for customers—greater display and attractiveness.

General inspection of the fluorescent unit



Life test of fluorescent lamp starters

2 OF THE 50 RIGID SPECIFICATION TESTS
OVER 40 LEADING FIXTURE MANUFACTURERS PARTICIPATE IN THE FLEUR-O-LIER PROGRAM

FLEUR-O-LIER *Manufacturers*

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

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Please send me new booklets about Certified★ FLEUR-O-LIERS, packages of indoor daylight for stores ☐ offices ☐ factories ☐

Name _____

Address _____

City _____ State _____

Questions ON THE Code

Answered by
F. N. M. SQUIRES
Chief Inspector New York Board of Fire Underwriters

Gunpowder Factories

Q. *"As a result of the National Defense Program, we have recently received inquiries for equipment to be used in powder loading plants. I cannot find a classification for this type of hazardous location in the National Electrical Code. Please advise us if you have had any experience in connection with equipment suitable for installation in gunpowder factories. Would you consider that this comes under a Class 1 or a Class 2 hazardous location? Would you consider oil immersed equipment more suitable than air break for this application?"*—E.L.

A. There is no classification for this type of hazardous location in the National Electrical Code. Such a location is far more hazardous than any contemplated when the rules of Article 500 were promulgated. The thought is that such locations are too hazardous to attempt to use electrical equipment in them. Lighting of rooms in which explosives are manufactured, handled or stored, can be accomplished by placing the lighting equipment outside of the rooms, and letting the light enter through plate glass. Power equipment, such as motors, can likewise be located outside of the rooms and line shafting run through the walls into the rooms. In this way all of the electrical equipment, including wiring, lighting fixtures, motors, control and protection equipment for both light and power can be kept out of the direct action rooms themselves and thus out in well ventilated spaces in clean air.

And then as an extra precaution dust-tight equipment, preferably, oil immersed where possible, could be employed even though the equipment is outside of the action rooms. The dust-tight equipment is undoubtedly preferable to the explosion-proof on account of the low temperatures at which some of this material will ignite.

Of course where the electrical equipment is used near to substances which have a highly volatile solvent the explosive-proof equipment should be used.

Multiplying of Service

Q. *"I have a 3 phase service, 2½-in. conduit, 3 No. 0000 wires, 200 amp. 3 pole switch. If the demand rises too high, the local Lighting Co. suggests I run a duplicate service 2½-in., 3 No. 0000 wires, 400 amp. cabinet. Are two separate services allowable as per Code to one cabinet and one meter?"* —E.R.P.

A. Yes, this would be permissible provided the service conductors which are to be multiplied are joined together, both mechanically and electrically, at *both* ends as required by Section 3008 of the Code. This means that the Utility must siamese the service wires at the service head as well as at the service switch.

ALLAN MILLER, registrar of contractors for the state of California, and Roy Butcher, San Jose electrical contractor who is chairman of the Contractors' License Board.

A Motor Connection

Q. *"I have three motors, each operated by a magnetic starter, and each of these in turn controlled by a thermostat. I wish to connect one solenoid valve so that when any one of the starters is energized the solenoid valve will be energized. I am connecting to a three-phase four-wire system and wish to know if the Code will allow connecting one lead of the solenoid valve to the like wire on the load side of each starter and the other solenoid load to the fourth or neutral wire? In this case, when one starter is energized, there would be a hot lead running from the two de-energized starters to their respective motors. Or is it necessary to use relays to accomplish this?"*—B.A.S.

A. If each motor is served by a separate disconnecting means ahead of its own controller, the method shown would defeat one of the purposes of the disconnecting means by leaving one wire to each of the motors alive when any one motor was running.

But if all three motors are served by a single disconnecting means as permitted in Section 4410 of the Code, then the method shown should be permissible.

Slow Burning Wires Only in Hot Places

Q. *"Rule 3203 states that slow-burning wire (type S.B.) can be used for open wiring on insulators in dry locations, but the table in 3005 also 3305a states that it can be used only in dry locations where the room temperature exceeds 185°F. "Which rule is correct?* —F.R.B."

A. Both rules are correct and both rules must be followed. Slow burning wires can be used only in dry locations where the temperature exceeds 85°C (185°F) whether in open wiring or in conduit.

Fuses on Branch Circuits

Q. *"Note 4 on page 303 of the 1940 Code states that the allowable carrying capacity of table 2 can be used for open wiring on insulators and for concealed knob and tube work.*

"This would allow No. 14 wire to be fused at 20 amp. which I should think would be considered a 20 amp. branch circuit, but rule 2135 states that medium duty lampholders could not be used on

BE... Sure

STANDARDIZE ON...

APPLETON EXPLOSION-PROOF FITTINGS!

Don't take chances these days with hazardous locations! One ordinary switch, or receptacle, or lighting fixture, *in the wrong place,* can cause untold property damage and loss of life, and might even shut down an important defense operation.

You can be *sure* you are taking every precaution possible, by standardizing on Appleton Explosion-proof Fittings. Every fitting in the vast Appleton Explosion-proof line is made in accordance with Underwriters' Laboratories standards, and offers a *wide margin* of protection. *Dust-tight,* as well as explosion-proof.

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There is an Appleton Explosion-proof Fitting for every possible need, described, diagrammed and pictured on the more than 100 pages of Section 12 of Appleton Catalog No. 11. We believe our line to be complete and satisfactory for all types of electrical installations in hazardous areas requiring explosion-proof or dust-tight protection. Make it *your convenient source* for all explosion-proof goods!

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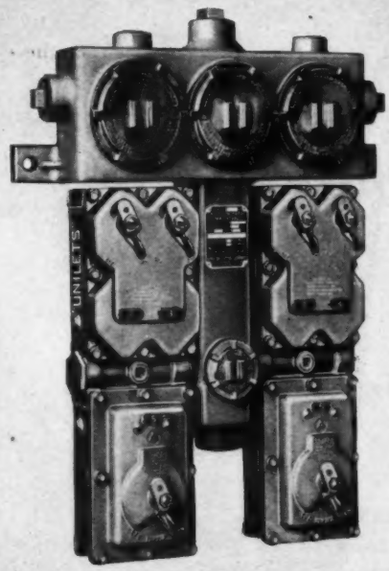
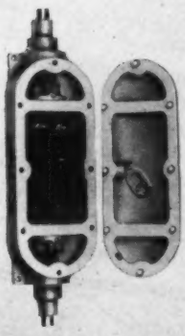


Type "FLP" Explosion-proof Panel Board (six-circuit)

Type "FSQX" Explosion-proof Interlocking Type Safety Switch and Type "FP" Plug

Type "EVA" Explosion-proof Lighting Fixture (pendent type)



Type "ARTC" Explosion-proof Circuit-breaking Switch (cover removed)

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GE3015 for 3¼" outlet box, 7" chain

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GE3017 for 3¼" outlet box, short chain and cord

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These good looking receptacles are much lighter in weight than porcelain and are easy to handle. Wiring time is saved because they have more wiring space and wiring is easier. Binding screws accommodate No. 12 wires providing greater wiring flexibility. Breakage is practically nil. The increased base diameter will conceal broken plaster around the box.

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For further information see the nearest G-E Merchandise Distributor or write to Section D-184, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

GENERAL ELECTRIC

Questions on the Code

[FROM PAGE 78]

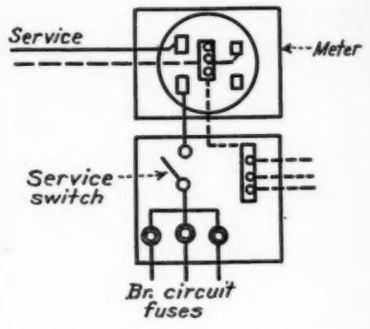
this type of circuit unless of porcelain keyless type on a special lighting unit. Therefore how could it be fused at 20 amp. if regular medium duty lampholders are to be used?"—F.R.B.

A. The 20 ampere rating given to No. 14 Type R wire in Table No. 2 can be used on a motor circuit to supply current to a motor with a full load rating of not over 12 amperes. Also with open wiring or knob and tube work, a 20 ampere branch circuit could be wired with No. 14 wire provided all of the provisions of Sections 2131 to 2135 incl. are complied with.

Service

Q. *"Rule 2371 of 1940 Code states that, 'Each ungrounded service entrance conductor shall have overcurrent protection', except (as Par. 3) 'not more than six sets of fuses may serve as the overcurrent device.'*

"Does this mean that if a one family house was wired as shown below, no main service fuse would be required?" —F.R.B.



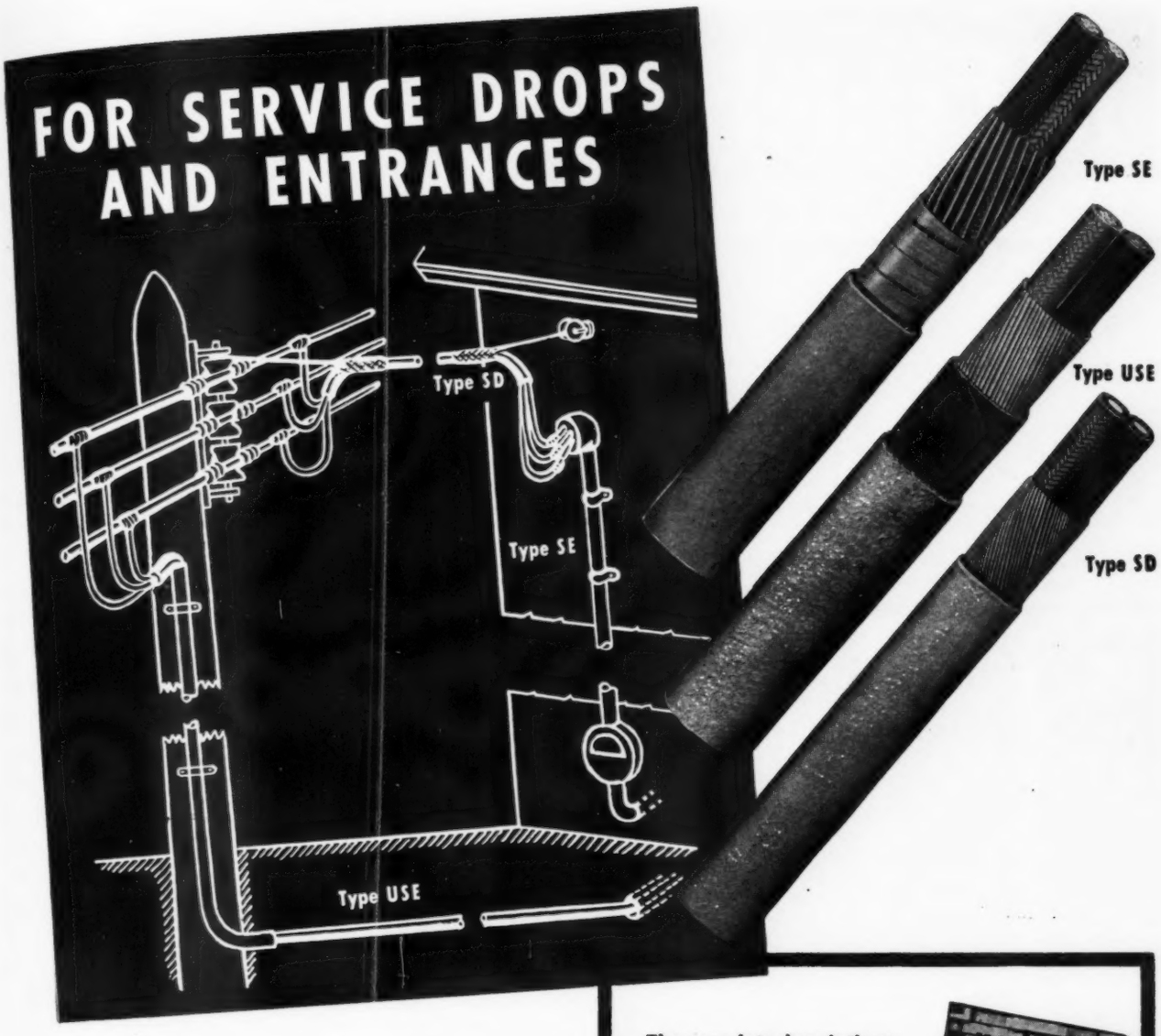
A. Yes, the above is correct. Of course the fuses have to be immediately adjacent to the service switch. (Section 2372)

Separation Between Conduit and Steam Pipes

Q. *"It seems to me that the National Electrical Code at one time had a note on how far electrical conduits, (that is metal conduits) should be kept from steam piping. I cannot find it in the 1940 Code."*—D.J.C.

A. The National Electrical Code does not now give any rule relative to a required distance which

FOR SERVICE DROPS AND ENTRANCES



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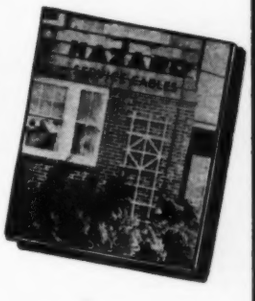
The illustrations show typical applications of Hazard Service Entrance and Drop Cables for making service connections.

For many installations, rigid conduit for entrances is unnecessary. The strong, flexible sheath of Hazard Service Entrance and Drop Cables provides the needed protection, while the concentric uninsulated neutral makes diversion a practical impossibility.

The complete descriptions and concise technical data contained in our booklet #528, Hazard Service Cables, will be valuable to you. Write for a free copy today.



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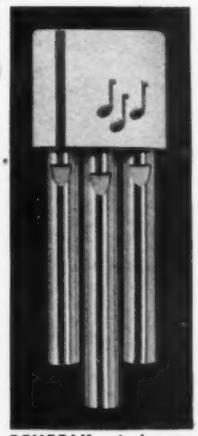

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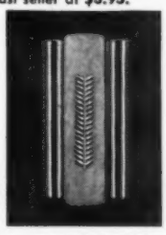

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SALES figures show that Rittenhouse electrical contractors are "trading up" and making bigger profits by pushing ***quality*** instead of ***price.*** There is a definite demand for Rittenhouse Quality Chimes in every locality because "they're a lot of chime for the money." They've got everything—golden tone, smart styling, superb construction, exclusive mechanical features. Famous movie and radio stars select Rittenhouse Chimes for their homes. Prominent builders and electrical contractors specify them for new homes. For customer satisfaction, specify Rittenhouse Chimes. Ask your wholesaler or send for catalog of 1941 models.

A. E. RITTENHOUSE CO., Inc., EC-4, Honeoye Falls, N. Y.

Questions on the Code

[FROM PAGE 81]

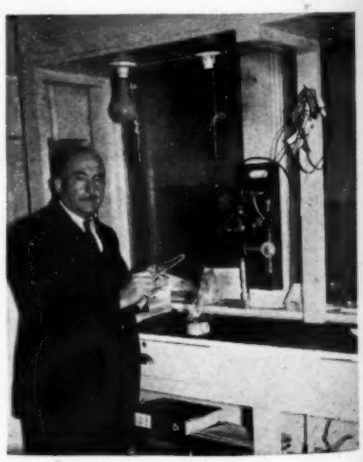
must be maintained between electrical conduit and steam pipes, nor is any such requirement recalled in former issues of the Code.

This matter must be treated with respect to the temperatures to which the conductors within the conduit may be subjected.

Any heat which may be added to the conductors which results in temperatures of over 30° C (86° F) will reduce the allowable carrying capacities of the wires in accordance with the temperature correction factors which are at the bottom of Table 1 (page 301) of the 1940 Code. And of course excessive temperatures hastens the deterioration of insulations.

As an example, if we had a feeder of 3 No. 6 wires in a conduit at the normal room temperature of 30° C, the carrying capacity of the No. 6 wire would be, for Type R wire, 45 amperes; but if the temperature of the wires was raised by the proximity of steam pipes (or other heat) to 45° C (113° F) the carrying capacity would be only 50 percent of the 45 amperes or only 22½ amperes.

But if the temperature of the wires in the conduit is raised to 50° C (122° F) the carrying capacity of the type R wire (and any type R wire) is reduced to 0.



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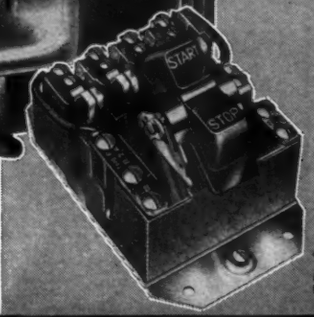

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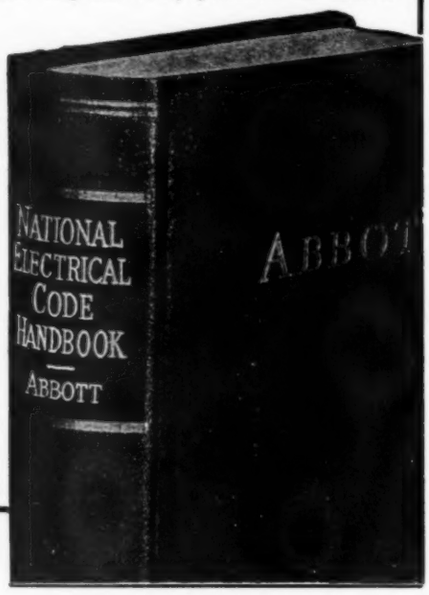

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covering the new 1940 Code

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Some of the features

- Contains a handy reference table that shows at a glance just what lighting and appliance loads may be connected to each of the five types of branch circuits described in Art. 210.
- Concisely explains complicated new rules in the Code under which 17 different types of insulated conductors are recognized.
- Clarifies provisions relating to carrying capacities, rubber-insulated wires, small-diameter wires for rewiring, insulations for extra high temperatures, etc.
- Presents the motor wiring and protecting tables, always an important feature of the Handbook, in a new form which makes easy the solution of problems which arise when determining the rating or setting the fuses or circuit breakers protecting motor branch circuits.

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Inside the Fluorescent Lamp

[FROM PAGE 21]

absorbed in the phosphor coating, there being transformed into visible light.

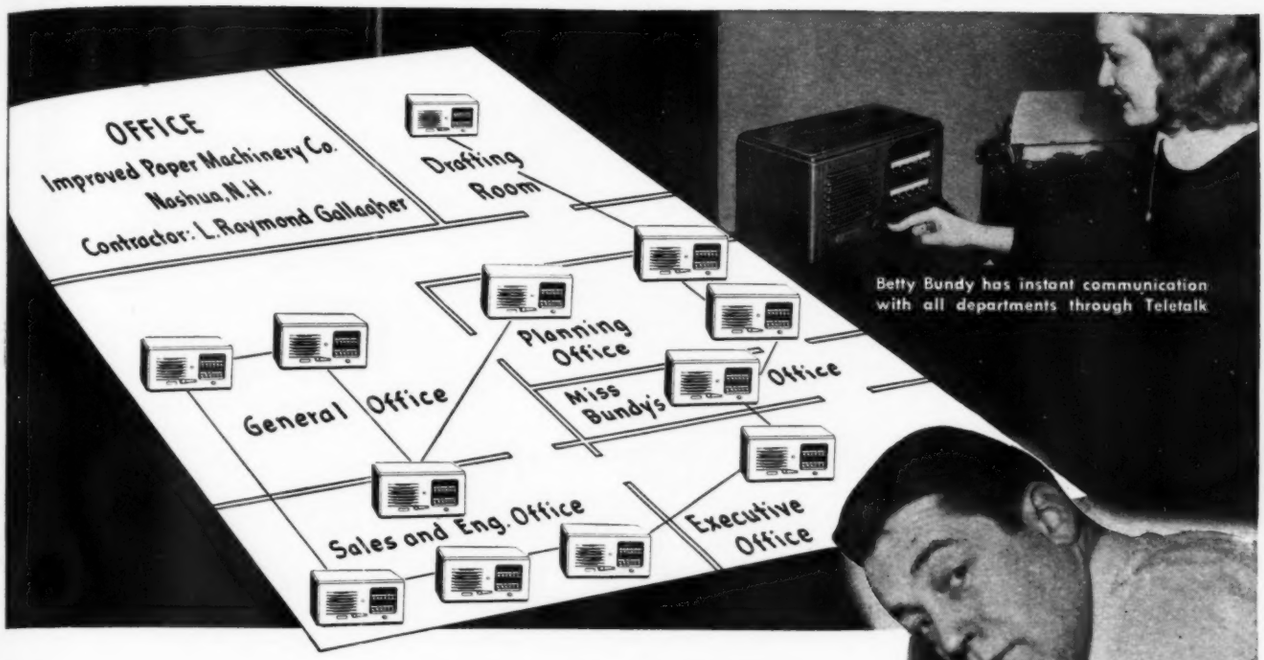
The effects of line voltage on fluorescent lamp performance is seen in the accompanying curve. It may be noted that, in light output, these lamps are not as sensitive to the line voltage fluctuations as a mazda tungsten filament lamp would be. Nevertheless any very wide deviations from rated voltage will cause a change in the operating current and other characteristics and reduce the life of the lamp.

Candle-Power

As the lamp burns, its initial candlepower drops somewhat during the first 100 hours or so of burning. Most of this initial change is worked out of the lamp during its seasoning at the lamp factory, yet the lumen ratings are established on performance after 100 hours of burning. Beyond that point there is still a gradual but slight dimming such that at about 70 per cent of average life the rating is some 85 per cent of the initial value. Also the gradual depreciation of the electrodes may cause darkening of the ends of the tube. Sometimes this is aggravated by improper voltage and current conditions or by inadequate current supplied by an improper ballast.

The fluorescent lamp will burn equally well in any position. It will withstand normal vibration and it runs cool. It is not essentially an outdoor lamp and should always be protected from cold drafts. It will do its best in air temperature at about 80° F; less well at temperatures higher and lower than this. It may fail to start altogether in air temperatures below freezing.

Occasionally a new fluorescent lamp will develop a whirling or moving action of the arc stream with an effect commonly called "wigglers". Usually, this is the result of a temporary condition of hydro-carbon vapors baking out of the electron emission coatings. Ordinarily where the lamp is operated with approved auxiliaries, this condition will age out and disappear in a short time. Most other troubles are like this one, and may be properly classified as the inevitable growing pains of a new and critical product which cannot be haphazardly made and demands judgment in its usage. A good fluorescent lamp, functioning well throughout its 2500 hours life produces potentially high footcandle levels with minimized radiant heat.



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150′ of 13-pair cable
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12 duplex receptacles with boxes
1 pound clips
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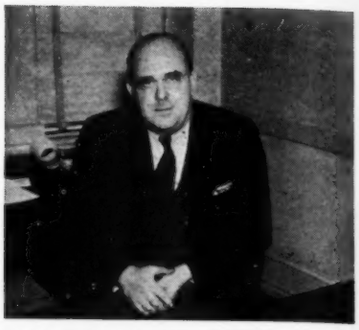


ENGINEERING is a vital part of the present-day electrical contractor's make-up, according to Stanley M. Cameron, vice-president of the Howard P. Foley Company, one of the nation's largest electrical construction firms. Stan, who is in charge of the company's Philadelphia office, believes that for every dollar spent in the office on detail layouts you save two in the field.

ROCKY MOUNTAIN LEAGUE CONFERENCE

A three-day spring conference of the Engineering and Accounting Sections of the Rocky Mountain Electrical League was held in the Shirley-Savoy Hotel, Denver, Col., March 13 to 15. Electrical industry representatives present included engineers, accountants, lighting salespeople and electrical contractors. Others present were architects, building managers and engineers, plant superintendents, operating and construction men, manufacturers and distributors.

The conference opened with a lighting institute, consisting of General Electric's newly-perfected traveling lighting laboratory, in charge of James M. Ketch. The Engineering Clinic the following day featured D. K. Blake, director, Distribution System Section, General Electric Co., Schenectady, as the principal speaker. His subject was "Problems in Distribution Engineering Design and Continuity of Service." Other subjects discussed at this session included safety, electrical apparatus, plant rehabilitation, employee relations, personnel problems, street and highway lighting and adequate wiring.

The meeting of the Accounting Section provided many new ideas on accounting trends and problems. Following the opening session of this and the Engineering Section a joint luncheon meeting of the two groups was held.

TENNESSEE CONTRACTORS MEET

The Tennessee Electrical Contractors Association held its annual convention at the Hotel Andrew Johnson, Knoxville, Tennessee, on March 17 and 18. There was an attendance of more than 100.

A. J. Thompson of Memphis, president of the Association presided at the first day's sessions, turning the gavel over to the incoming president, C. R. Wright of Knoxville, who conducted the balance of the meeting.

The first morning's session was devoted to reports of activities for the several chapters; W. G. Gale reporting for Knoxville, Philip Sweet for Chattanooga, and Albert Gross for Memphis. Memphis reported the establishment of an Apprentice Training Program in their city, and Chattanooga is contemplating a similar program.

At the Monday afternoon session, R. K. Robinson, president, and Dwight L. Casey, secretary of the North Carolina State Electrical Contractors Association, both from Charlotte, gave talks on the activities of their association. L. W. Davis, General Manager of the National Electrical Contractors Association discussed many of the national problems facing the electrical contracting industry today.

The principal address at the annual banquet that evening was given by James P. Pope, Director of the Tennessee Valley Authority.

At the Tuesday morning session, H. M. Horton, Lighting Engineer, G. E. Lamp Division, discussed the contractor's place in the new "Light Source Picture," and H. G. Meyer, Prof. of Accounting, University of Tennessee talked on the "value of accountancy to electrical contractors."

At the annual election, the following officers were selected—president, C. R. Wright, Knoxville; first vice-president, Herbert Haile, Chattanooga; second vice-president, Ray Edenfield, Nashville; third vice-president, Albert Gross, Memphis; secretary-treasurer, Philip Sweet, Chattanooga; Executive Committee, A. J. Thompson, Memphis, and W. G. Hoffman, Knoxville.

***REELECTED PRESIDENT** of the Wisconsin Electrical Association, R. J. Nickles, of Madison (seated) confers with E. H. Herzberg, secretary-manager, on the promotion of a license bill before the Wisconsin legislature.*

C. W. MOSELEY ON SAFETY CODE COMMITTEE

C. W. Moseley, engineer for R. H. Bouligny, Inc., Charlotte, N. C., has been appointed by President McChesney to represent NECA on the National Electrical Safety Code Committee in the place of N. P. Hoisington, who has served on that committee for the past two years.

This National Electrical Safety Code is developed under the sponsorship of the National Bureau of Standards, Washington, of which Lyman J. Briggs is Director. Dr. Morton G. Lloyd of the Bureau of Standards is Chairman of the Committee having the Code in charge. The revisions are carried out according to the procedure of the American Standards Association, and the Sectional Committee of the Industry under Dr. Lloyd is organized according to the rules of procedure of the ASA.

CERTIFIED FIXTURES READY

Following nearly a year of study, the first group of residential lighting fixtures produced under the Specification-Certification Program of the American Lighting Equipment Association is now under examination by the Electrical Testing Laboratories. Incorporating the Illuminating Engineering Society's "Recommended Practice for the Illumination Performance of Residential Ceiling Luminaires," the A.L.E.A. Specification-Certification Program marks the first effort of the residential lighting fixture industry to produce certified fixtures.

The fixtures made in accordance with the A.L.E.A. specifications reflect distinct improvements in appearance as well as performance. They are expected to effect a noteworthy contribution to residential lighting service. The certification tags will testify that the new fixtures meet the lighting specifications as well as the

Now BENJAMIN Brinqs You NEW FLUORESCENT LIGHTING ADVANTAGES

LITE-LINE

FLUORESCENT LIGHTING SYSTEM

UNBROKEN LINES OF LIGHT . . . ROW ON ROW ALONG

ENTIRE CEILING . . . PROVIDING 35 TO 70 FOOTCANDLES!

INVESTIGATE ALL THESE "LITE-LINE" ADVANTAGES; SEND FOR "DATA SHEETS" TODAY

- MORE LIGHT
- MODERN APPEARANCE
- UNIFORM ILLUMINATION
- EASY, LOW COST MAINTENANCE
- LOWER COST INSTALLATION
- BENJAMIN DEPENDABILITY
- REMOVABLE REFLECTORS
- LOWER WIRING COSTS
- CONVERTIBILITY TO THREE LAMP OPERATION
- PORCELAIN ENAMEL DURABILITY
- RLM LABEL

"Lite-Line" RLM Reflectors are easy to remove from the wiring channel.

(Right) How "Lite-Line" Units are joined together to form an unbroken line of any desired length. *(Above)* The double reflector "Lite-Line" Unit which is available with twin or triple lamp reflectors. Unit is also available in single reflector lengths.

MORE light, in a more modern form, at lower cost. There you have the essence of what is offered to you in the Benjamin new "Lite-Line" 48" Fluorescent Lighting System.

Higher levels of Fluorescent illumination to improve production, accuracy of workmanship, safety and all 'round employee efficiency by increasing the *speed and ease of seeing,* can now be secured in an even more practical and efficient manner through the installation of these new Benjamin units. "Lite-Line" marks a further step in the development of continuous line Fluorescent lighting originally introduced several years ago by Benjamin in its Flur-O-Line Equipment.

"Lite-Line" enables you to reduce the cost of installation and wiring as less outlets, conduits and fittings are required due to the fact that the greater part of the branch circuit runs are inside the housing. It enables you to have Fluorescent lighting in its most modern form...to provide easily and economically, higher levels of uniform illumination. It enables you to utilize the continuous line method for both general illumination and localized lighting of work tables, assembly lines, etc.

Benjamin "Lite-Line" Units embody many new and exclusive features which combined with Benjamin's "battleship durability" make this unit the choice of all those who buy today with an eye on tomorrow. In this unit, provision may be made for changeover from two to three lamp operation on any part or all of the line. The special *"Removable Reflector"* feature cuts servicing and cleaning time. The special fittings to link the reflectors in series reduce installation time. The special high quality Benjamin Porcelain Enamel Reflectors insure easy cleaning and life-time lighting efficiency. Reflectors conform to RLM Specifications and approved lighting principles thus assuring maximum light output and correct light distribution.

Before you specify Fluorescent Lighting Equipment . . . write for the new Benjamin "Lite-Line" System Bulletin. Address the Benjamin Electric Mfg. Co., Dept. H, Des Plaines, Illinois.

40th Anniversary Year

Pioneers in Industrial Lighting

BENJAMIN

LIGHTING EQUIPMENT

Distributed Exclusively Through Electrical Wholesalers

In the News

[FROM PAGE 86]

A.L.E.A.'s conception of proper design and quality.

The certified fixtures are designed primarily for living, dining and bedrooms, where illumination performance is a major factor.

Manufacturer-members of A.L.E.A. are required to submit samples of eligible fixtures to the Electrical Testing Laboratories for testing and inspection. Only those fixtures conforming to the illumination specifications and design requirements will be permitted to carry the certification tag.

MAINTENANCE ENGINEERS STUDY INDUSTRIAL LIGHTING

Modern developments in industrial lighting equipment and methods were reviewed by Chicago Electrical Maintenance Engineers in a meeting at the Chicago Lighting Institute on March 26. A discussion of basic light sources and their application to specific industrial problems was conducted by Walter N. Aldrich of Westinghouse and Charles R. Stover of General Electric, covering fluorescent, incandescent, mercury and infra-red lamps.

The facilities of the recently remodeled industrial lighting laboratory of the Institute were used in a demonstration of lighting problems and applications by Edwin D. Tillson of Commonwealth Edison and G. K. Hardacre of Public Service of Northern Illinois.

General discussion indicated an upswing in interest among electrical maintenance engineers in lighting due to extensive night shift operations in industrial plants in the Chicago area.

WIRE COVERING

The rules for the conductor insulation of several standard asbestos covered wires have been changed. The Electrical Committee N.F.P.A. announces these requirements as follows—

For asbestos synthetic—SNA—flame-retardant cotton braid.

For asbestos-varnished cambric—AVA—asbestos braid.

For asbestos-varnished cambric—AVB—flame-retardant cotton braid.

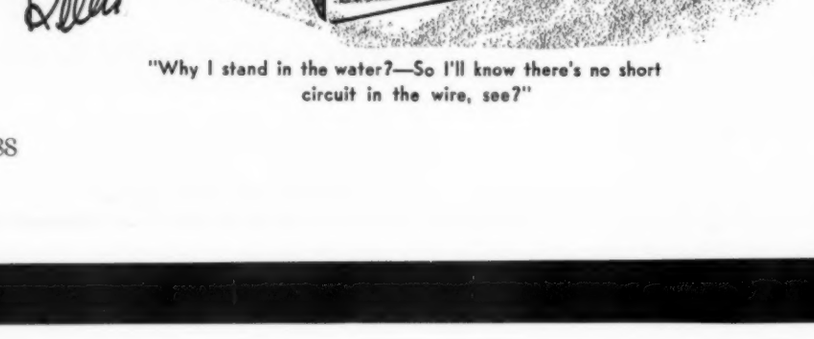
For asbestos-varnished cambric—AVL—lead-sheathed.

For asbestos—A—with or without asbestos braid.

For impregnated asbestos—AI—with or without impregnated asbestos braid.

LEAGUES GET NEMA APPROVAL

Thirteen electrical leagues, to date, have met the standard of operation and received Certificates of Approval from the National Electrical Manufacturers Association.



"Why I stand in the water?—So I'll know there's no short circuit in the wire, see?"

DAN BRONSON at the right is the new president of the Electrical Contractor's Assn. of northern California. Ted Curry, left, of Fresno, was a delegate to N.E.C.A. convention from the association.

They are the Electrical Association of Chicago; Electrical Association of Rochester, Inc.; Electrical League of Rhode Island, Providence; Electrical League of Utah, Salt Lake City; Pacific Coast Electrical Association; Electrical League of Cleveland; Electrical & Gas Association of New York, Inc.; Electrical Association of the Niagara Frontier, Buffalo; Electrical Association of Kansas City, Mo.; Electrical League of Indianapolis; Rocky Mountain Electrical League, Denver, Colo.; and the North Central Associated Electrical Industries, Minneapolis, Minn. Other requests for approval are now under consideration.

TWIN CITY CONTRACTORS NAME OFFICERS

Elected at the annual meeting of the St. Paul, (Minn.) Master Electrical Contractors Association, Wm. F. Lindberg was named president; J. A. Fischler, vice president; A. W. Swanson, secretary and W. F. Jacobs, treasurer according to an announcement by the Minnesota Electrical Council.

Members of the executive committee are Fred Page, F. W. Hoeft, R. C. Gombold, Otto Johnson and Otto Nelson.

In Minneapolis, A. L. Glatty was elected president of the Minneapolis Electrical Contractor Association, Otto Willis, vice president and H. J. Mester, secretary-treasurer. The directors are J. R. Hanzlik, A. W. Starbird, John Kvalsten, Leon Prall and F. M. Tripp.

BUILDERS HEAR ADEQUACY STORY

The subject of adequate wiring in the new home was a feature of the Fifth Annual Convention of the Wisconsin Constructors, Inc., held at Fond du Lac.

Following the routine business of this building contractors group, Arthur E. Schanuel, field representative of the National Adequate Wiring Bureau, told the adequate wiring story and briefly reviewed the operation of the certification plan.

Modern Porcelain Protected Wiring Systems Include Installation by Electrical Contractors and Skilled Wiremen

No wiring System is Foolproof—Even the Fine Quality of Electrical Porcelain Wiring Materials Depend Upon Skilled Installation for Greater Safety and Adequacy.

Modern Porcelain Protected wiring does not permit "fake neutrals." Where mechanical protection is required, it is installed for that purpose only. Where grounding is required, a solid, independent electrical circuit is provided.

Modern Porcelain Protected wiring is designed for and by electrical contractors. It is an integration of high dielectric porcelain, wire of adequate capacity and quality devices installed with the experienced skill of trained wiremen. "For a safe, adequate modern Porcelain Protected Wiring System, consult your electrical contractor."

You cannot *buy* modern Porcelain Protected wiring across the wholesaler's counter. The fine quality and inherent protection of electrical porcelain are only part of the modern porcelain protected wiring system. Skilled installation is equally important.

The materials which enter into a Porcelain Protected wiring system will, with skilled workmanship, provide the utmost of safety and permanence. Competent design and layout will provide the best adequacy standards at low cost.

Electric porcelain materials for interior wiring are carefully designed for speedy installation by skilled mechanics and are readily adaptable to all conditions encountered on the job. They are not "simplified" for the handyman or amateur wireman. The manufacturer of electrical porcelain can maintain the highest standards of insulation, adaptability and rugged design, but important installation factors such as conductor spacing and grouping, neutral identification, grounding and circuit adequacy are directly under the control of the electrical contractor.

Modern Porcelain Protected wiring is the only wiring system which gives the electrical contractor full independent control over the electrical characteristics and workmanship of his installation. It offers the contractor the widest opportunity to express his skill in installation, layout and design for safer and more adequate systems.

Skilled workmen recognize the high insulating qualities of electrical porcelain and Porcelain Protected Systems are an indication of skill and experience. The "jerry wiring" jobs installed by amateurs and handymen never include modern Porcelain Protection. Ask your electrical inspector.

Electrical porcelain materials for Modern Porcelain Protected Wiring Systems are manufactured by:

Porcelain Products, Incorporated, Findlay, Ohio

Illinois Electric Porcelain Company, Macomb, Ill.

Knox Porcelain Corporation, Knoxville, Tenn.

and may be obtained through your electrical wholesaler.

ADVERTISEMENT

TRUMBULL

JUST PLUG 'EM IN . . AND YOU'RE READY TO GO

Ready NOW to meet every need of expanding industry, five basic types of FLEX-A-PLUGS permit complete flexibility in installation, relocation or addition of machines and equipment, simply by plugging into the run of FLEX-A-POWER.

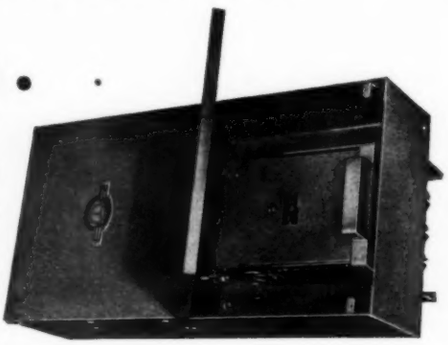
In addition to NEW Capacitor and Neutralizer FLEX-A-PLUGS described below the complete line includes:

- **A fused Disconnect Switch (F L)**
- **A heavy duty Type R B A Motor Circuit Disconnect (F D)**
- **A Type A T Circuit Breaker Disconnect (F E)**

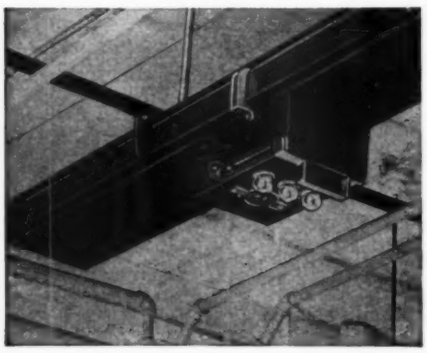
NOW is the time to sell FLEX-A-POWER and FLEX-A-PLUG speed and economy to busy defense industries everywhere.

• NEW •

CAPACITOR FLEX-A-PLUG



Compact, easily installed means of improving power factor of entire system and guarding against trouble and losses due to possible overload conditions. Capacitors can be distributed and relocated to meet load conditions.



NEUTRALIZER FLEX-A-PLUG

Another recent Trumbull development, normally placed at ends of runs. Equipped with neon glow lamps on each phase which visually indicate grounds that may occur on any connected equipment, saving time and trouble, reducing danger of lengthy shut downs.

Be sure you have latest TRUMBULLAID Bulletin No. 408.

THE TRUMBULL ELEC. MFG. CO. PLAINVILLE CONN. U.S.A.

KEEP *Alert* ELECTRICALLY use your TRUMBULLAIDS

NEW YORK - PHILADELPHIA - BOSTON - CHICAGO - DETROIT - LUDLOW, KY. - ATLANTA - NASHVILLE - LOS ANGELES - SAN FRANCISCO - SEATTLE

In the News

[FROM PAGE 81]

Les Falk, Wisconsin Power & Light Co., gave his visual demonstration of the increased use of electricity by the home owner and the waste and inconvenience of inadequate wiring.

At the conclusion of the meeting, the Fond du Lac A.W. Bureau awarded its first three A.W. certificates, the presentations being made by Mayor L. J. Promen.

COMING MEETINGS

Wolverine State Electrical Contractors Association — Annual Convention, Occidental Hotel, Muskegon, Mich., April 18–19.

National Electrical Manufacturers Association—Spring Conference, The Homestead, Hot Springs, Va., May 11–15.

National Electrical Wholesalers Association—The Homestead, Hot Springs, Va., May 18–22.

National Industrial Service Association—Annual Convention, Hotel Statler, Buffalo, N. Y., May 19–21.

New York State Association of Electrical Contractors & Dealers—Saranac Inn, Saranac N. Y., July 7–10.

National Electrical Contractors Association—Annual Convention, Rice Hotel, Houston, Texas, Oct. 6–8.

National Electrical Manufacturers Association—Annual Meeting, Waldorf-Astoria Hotel, New York, N. Y., Oct. 27-31.

NISA CHAPTER ELECTS OFFICERS

The new Wisconsin Chapter of the National Industrial Service Association announces the election of the following officers. President, Al Tellier; First Vice-President, C. L. Harry; Second Vice-President, W. J. Bentley; Secretary-Treasurer, Roy Schulz; Executive Secretary, E. H. Herzberg.

The New Orleans chapter announces the slate to guide this local organization of motor shops during the coming year. President, Henry Muller; Vice-President, S. J. Stewart; Secretary-Treasurer, L. Bonnecaze, Jr.

FLUORESCENT LAMP BOOM

Manufacturers of fluorescent lamps have recently received three very large orders that are keeping them all stepping. General Electric is providing 11,640 of the 60 inch, 100 watt size to Packard Motor plants. Westinghouse will supply 35,000 of the 48 inch, 40 watt lamps to the Vega Airplane Co. a branch of Lockheed in Burbank, California. Hygrade Sylvania has an order from the Government for 28,200 fluorescent lamps of various sizes.

To handle the growing volume of this

ALUMINUM, DEFENSE, AND YOU

WE INTERRUPT our regular messages to report what's what with aluminum.

AT THE MOMENT delivery for civilian use must make way for defense. Everybody knows the reason. Defense requires and is using more aluminum per month than peacetime America ever consumed.

NEVERTHELESS, we intend that no one shall have to forego the things aluminum can do best one minute longer than we can help.

THERE IS NO SHORTAGE of bauxite, nor of anything else, except time. And Father Time is being given the race of his life.

WE ARE MOVING, for example, 35,000 yards of earth a day at Alcoa, Tenn., to get 50 acres under a single roof by September. It will require 193 carloads of roofing felt. Some of the operations in that plant will start even before the walls are up. That's an annual rolling capacity for 120 million pounds of high strength alloy sheet coming along fast.

LAST MARCH WE STUCK the first shovel in a cow pasture near Vancouver, Wash. In September a 30 million pound plant was delivering metal. It has been doubled, already. A third 30 million pound unit starts delivering in April; a fourth in May; a fifth in June. From cow pasture to 150 million pounds annual capacity in 15 months.

A SIDELIGHT: To make that 150 million pounds of aluminum, we first have to build factories to make 120 million pounds of carbon electrodes. We have to obtain the equipment (transformers, rectifiers, and the like) to feed 162,500 kw. of electricity into the reduction furnaces. This is a generating capacity equal to that of the state of Delaware plus twice that of Mississippi.

WHAT OF TOTAL PRODUCTION? In addition to Vancouver, further installations are being made at other of our plants, so that in less than a year their total capacity will be more than double that of 1939, when 327 million pounds were produced.

IN THE VERY MIDST of this demand we have lowered the price of aluminum ingot 15%. We state, without reservation, our hope that the price can be still further reduced.

DEFENSE APPLICATIONS use aluminum for exactly the same reasons you do. Defense priorities on aluminum simply say that there are some fundamental things that aluminum does supremely well. It will do them still better as important lessons in production, fabrication, and application are learned from every additional pound being produced and used.

YOU, SIR, have been using aluminum in many forms, for many different purposes. It is not easy nor convenient to have to substitute other materials temporarily. We want you to know that we intend to make this hardship as short-lived as possible. Your aluminum is on the way. It is a promise.

ALUMINUM COMPANY OF AMERICA

Made For PROGRESSIVE CONTRACTORS

IDEAL

NEW — BX ARMOR CUTTER

- Cuts armor from 2 or 3 wire No. 12 or No. 14 BX in one operation.
- No more nicked insulation, shorts or wasted BX.
- Pocket size, inexpensive.
- Just open jaws and snip!

NEW — IDEAL "SNAP-TITE" SWITCH BOX SUPPORTS

- Holds switch box in composition walls.
- No screws or special tools required.
- Fits all standard boxes.

NEW — IDEAL FISH TAPE, REEL AND PULLER

No. 00 "Handy Size"

- Prevents breakage—keeps fish tape under control.
- Complete with 50 feet of 1/8"x.045" tape.
- Reel gives sure grip eliminating special pullers.
- 3 tools in 1—only $1.50.

NEW — IDEAL JOIST BORING MACHINE

- Easily assembled.
- Bores at any angle through joists, rafters, etc.
- No climbing—no stooping —no straining.
- Works up to 11 ft. above floor.

NEW — IDEAL TEST-GLO

SAFE! Tests electrical and radio circuits, motors, fuses, etc. from 80 to 550 volts, A.C. or D.C.

IDEAL "WIRE-NUTS"

The Solderless, Tapeless Wire Connectors that make better wire joints, and at less material cost.

OTHER PROFITABLE ITEMS

IDEAL COMMUTATOR DRESSER COMPANY

1041 Park Avenue — Sycamore, Illinois

SALES OFFFICES IN ALL PRINCIPAL CITIES

In Canada: Irving Smith, Ltd., Montreal, Quebec

In the News

[FROM PAGE 90]

business, Westinghouse has begun the construction of a new $3,000,000 plant at Fairmont, West Virginia. It will have an initial capacity of 50,000 lamps a day. It will be lighted by fluorescent throughout.

General Electric is putting up a million dollar fluorescent plant at Jackson, Miss.

Starting in the Spring of 1938, the fluorescent lamp manufacturers sold 250,000 units before the end of that year. In 1939, they sold about 2,000,000. In 1940, their combined output was well over 7,000,000. And estimates for this year run anywhere from 15,000,000 to 20,000,000.

NEW CONTRACTOR GROUP

An organization meeting of thirty-four Idaho electrical contractors was recently held at the Lewis-Clark Hotel, Lewiston, to form the Idaho State Electrical Contractors Association.

Officers elected to guide the affairs of the new group include: president, W. H. Hopper, Boise; secretary-treasurer, J. Carl Baldridge, Boise. Sectional vice-presidents and secretaries are respectively: North Idaho—Les Stewart of Moscow and Gordon Defoe of Lewiston; Southwest Idaho —Kyle M. Waite and Al S. Gilbert, both of Twin Falls; Southeast Idaho—F. V. Hall of Pocatello and Elmer E. Smith of Buhl.

MOTOR REPAIR COST STUDY

The National Industrial Service Association's Cost Data Committee will make a survey of primary costs. It will be based on the actual dollar and cent cost of labor only, without any additions for overhead, profit or materials. This labor cost will include: testing, disassembling, stripping, cleaning, coil making, rewinding, dipping, assembling and painting frame.

The General Electric, type KT line will be used as the basis for the investigation. Four or five motors of each size will be included so that the study may be as true an average as possible.

CHICAGO WIRING CERTIFICATES DOUBLE

Heading into the spring home building season with a flying start, the adequate wiring activity of the Electric Association of Chicago, up to March 10, issued certificates of convenience and capacity to 444 single occupancies. This figure is more than twice the number certified in the corresponding period last year.

Two men were added April first to

MINERALLAC HANGER

Conduit 3/8"—2 1/2"
Cable to 2 1/8" (with Bushings)

Cadmium and Everdur
MINERALLAC JIFFY CLIP

Sizes from .250" O.D. Tubing to 1 1/4" conduit.

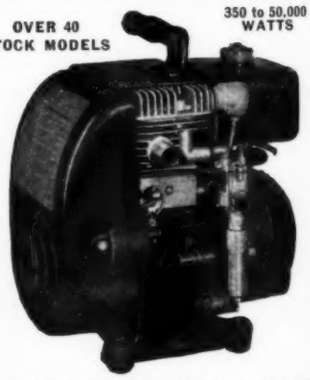
See your Jobber

New York City Office
Theodore B. Dally
50 Church Street

MINERALLAC ELECTRIC CO.
25 N. Peoria St., CHICAGO

ONAN DEPENDABLE ELECTRIC PLANTS

OVER 40 STOCK MODELS — 350 to 50,000 WATTS



ONAN ELECTRIC PLANTS have been giving SATISFACTORY PERFORMANCE for over 15 years in ALL PARTS OF THE WORLD. Dealers realize SATISFACTORY PERFORMANCE allows them to "Reap the Harvest" through added Sales.

Built COMPLETELY by D. W. ONAN & SONS, they are of SIMPLE, COMPACT, STURDY CONSTRUCTION, and incorporate HIGHEST QUALITY MATERIALS and WORKMANSHIP.

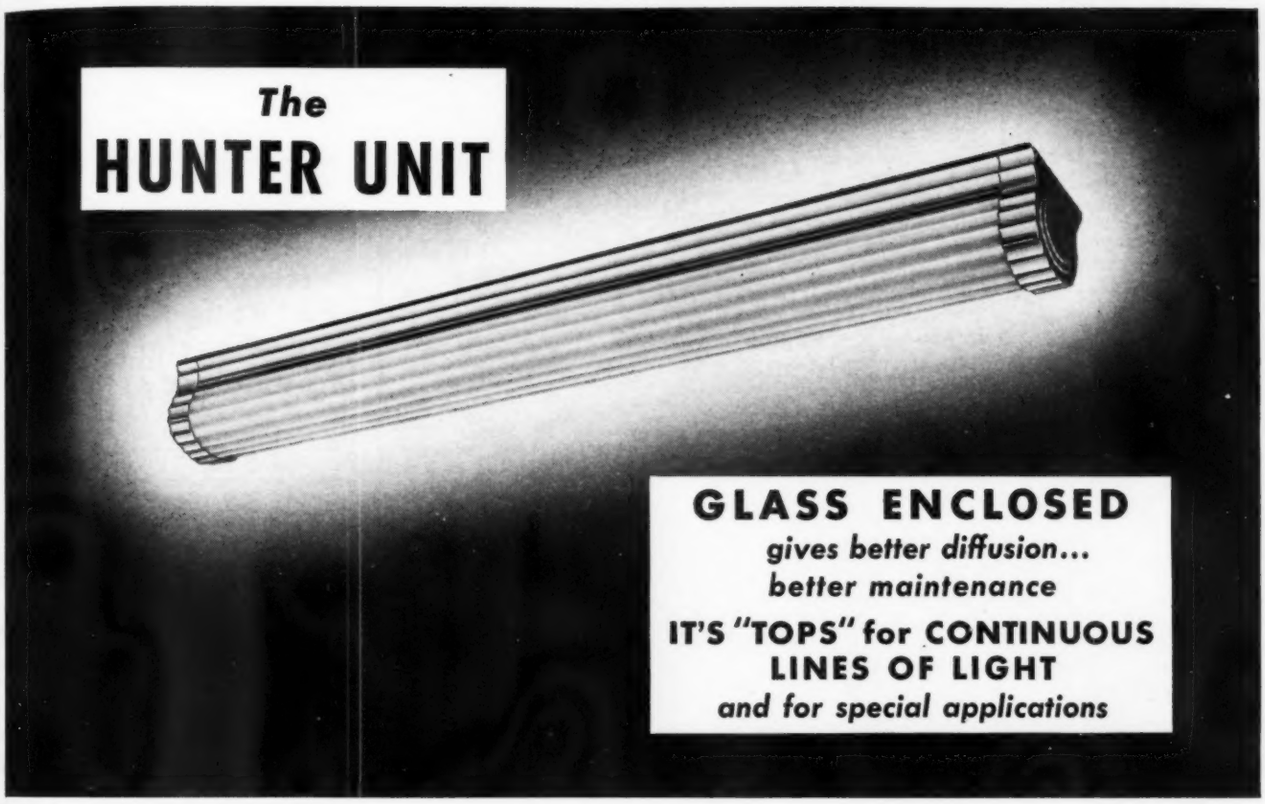
Used in HOMES, FARMS, SCHOOLS, THEATRES, PUBLIC BUILDINGS, CITY, STATE and FEDERAL DEPARTMENTS, BOATS, TRUCKS, TRAILERS, RADIO STATIONS, Many others. Operate LIGHTS, RADIO TRANSMITTERS and RECEIVERS, Motors, Tools, Appliances, X-Ray and other Medical Equipment and Standby Emergency Service in case of POWER LINE FAILURE.

Sizes through 50,000 Watts—any Voltage or Frequency—Air or Water-Cooled—Gasoline, Natural Gas, Oil or Diesel Powered,—110 or 220 Volt, A.C., 12, 32 or 110 volt, D.C. or any Special Voltages are available. Many NEW 1941 Models.

Write NOW for Complete Dealer's Proposition.

D. W. ONAN & SONS
794 Royalston Ave., Minneapolis, Minn.

New Wakefield *Fluorescent*



A certified **FLEUR•O•LIER** *unit...checked and certified by* **E.T.L.**

Now Wakefield makes it possible for you to sell diffused fluorescent strip lighting (no shielding necessary)—in single units or as long, graceful lines of light . . . which today find scores of effective applications.

Read These Strong Selling Advantages!

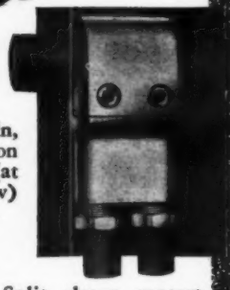
* The Wakefield HUNTER is a Certified Fleur-O-Lier, which means that it is checked and certified to 50 rigid specifications for good light and satisfactory service by impartial Electrical Testing Laboratories. *Reeded opal glass gives proper diffusion with *high transmission of light.* *Smooth graceful appearance with construction features hidden and all metal parts finished in white enamel. *Completely self-contained—with high power factor ballast equipment housed within the unit. Where two or more HUNTERS are interconnected, two-lamp ballasts are used to minimize stroboscopic effect. *Easy lamp removal. *High illumination levels obtainable—65 footcandles with 3-foot spacings. Write us for bulletin giving full details.

Wakefield also makes many other fluorescent lighting fixtures for COMMERCIAL use.

THE F. W. WAKEFIELD BRASS COMPANY

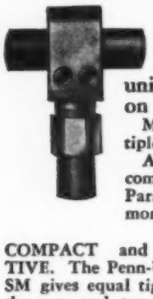
41 Contract Park, Vermilion, Ohio

The MOST COMPLETE
LINE OF
Tee Connectors



ALL good types —any size.

With a *hinged clamp* for the main, the Penn-Union Type HFM (at right, and below) is easy to apply.



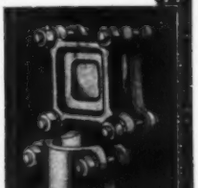
Split sleeve contact unit gives permanent grip on branch.

Made for single or multiple branch connections.

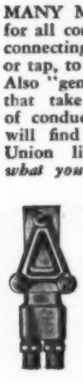
ALSO CABLE TAPS — a complete line of 90° and Parallel taps, for one or more branches.

COMPACT and POSITIVE. The Penn-Union Type SM gives equal tightening on the run and tap. Self-locking, dependable.

CLAMP TYPE TEES for all sizes of tubing and cable—a full line. Machined contact surfaces.



MANY MORE TYPES—for all combinations. For connecting flat bar, run or tap, to tubing or cable. Also "general utility" tees that take a wide range of conductor sizes. You will find that the Penn-Union line has *exactly what you need.*



FOR ANY CONDUCTOR FITTING—Terminals, Service Connectors, Studs, Two-Ways, Ground Clamps—see the THOUSANDS in the Penn-Union Catalog.

Preferred by the largest users, who have found that *Penn-Union on a fitting is the best guarantee of Dependability.*

Sold by Leading Jobbers

Write for Catalog

PENN-UNION ELECTRIC CORPORATION

ERIE, PA.

PENN-UNION
Conductor Fittings

In the News

[FROM PAGE 92]

double the staff of regular inspectors, which is augmented by utility company inspectors. Promotional activity is concentrating on reaching architects and builders at the planning stage. Several builders are including wiring certification as a standard feature of their homes.

JOINT FIXTURE PROMOTION WORKS

Increased fixture purchases are being felt by electrical contractors in southern California as a result of an inexpensive piece of cooperative promotion sponsored by the fixture manufacturers in that region. Contractors are selling better fixtures, both from the standpoint of real lighting and of price since this promotion started. They are aiding the good work by circularizing owners and building contractors with a sheet of "Home Lighting Suggestions" simply arranged to show several typical kinds of fixtures for the various rooms of a house.

At the bottom of the sheet is listed "a safe guide for lighting fixture allowances." Experience is showing that these suggestions have upped the average allowance for fixtures materially.

This cooperative publicity came about as a result of the loss of so much fixture business to portable lamps during recent years. Fixture manufacturers finally associated to do a selling job on the building public. A list of the members of Lighting Fixture Industries of Southern California is printed on the back of the suggestion sheet. Contractors, utilities and the association now circularize it to all interested prospects.

AKRON A.W. INCREASES

The Adequate Wiring Bureau of the Akron District reports 129 certified wiring jobs in 1940, a 200 percent increase over 1939. An analysis shows that 23 percent of all homes built in Akron proper during 1940 were certified, compared to 13 per cent in 1939. A total of 1,111 outlets, including switches, were added giving an average of 8.6 per certified home.

So far this year, 30 new homes started or planned up to the end of February will have certified adequate wiring.

TO MARK INSULATION

The Electrical Committee N.F.P.A. announces that hereafter "all single rubber-insulated fibrous-covered conductors No. 14

MULTI
"Fluoraine" Fluorescent FIXTURES

New construction and design features assure maximum lighting efficiency - - - -

The "FLUORAINE" provides an ideal single-unit light-intensity for close work which has never been achieved before. For general use in shops, storerooms, offices, etc. Can be mounted low because of cool operation—no reflected glare—easily cleaned with soap and water. Furnished unwired with equipment mounted in place—slight additional cost for wiring in advance. One-piece heavy steel gauge reflector, porcelain enameled. Send for bulletin containing all mechanical details.

MULTI
ELECTRICAL MANUFACTURING CO.
1840 W. 14th ST., CHICAGO, ILL.

Motor—Starting CAPACITORS

● It's one thing to get a real good capacitor. It's something else to be sure it's properly applied. Aerovox *guarantees* the first, and all but installs the unit in application.

●

Aerovox listings provide the most up-to-date, dependable data on motor-capacitor replacements. When necessary identification is absent, you can use the Aerovox Capacitor Selector to determine the proper capacity. And to get the motor going "in a jiffy", use an Aerovox Emergency Unit. Later, a Standard or Universal Replacement serves as the permanent installation.

***Ask for* MANUAL . . .**

Local Aerovox jobber will gladly give you a copy. Also, he'll supply you with required capacitors. Ask to see the Aerovox Capacitor Selector and the Emergency Unit. Or write us direct.

AEROVOX
CORPORATION
NEW BEDFORD, MASS.
IN CANADA: AEROVOX CANADA Limited

and larger shall have a readily identifiable permanent marking to indicate the grade of insulation, except that such marking need not be present when single conductors having code grade insulation are provided with a lead sheath."

"Single rubber-insulated fibrous-covered conductors having a lead sheath and all multi-conductor, armored and nonmetallic-sheathed cables containing rubber-insulated conductors shall be provided with a readily identifiable permanent marking to indicate the grade of insulation, if such insulation is of other than code grade."

NEW ASSOCIATION

A new association of electrical contractors and dealers of San Mateo County, Calif., has been organized. William F. Klose of San Carlos, Calif., was elected president and Joe Dingman of Redwood City, secretary. Meetings were held in February to discuss the new apprentice indenture and to negotiate for a new wage scale.

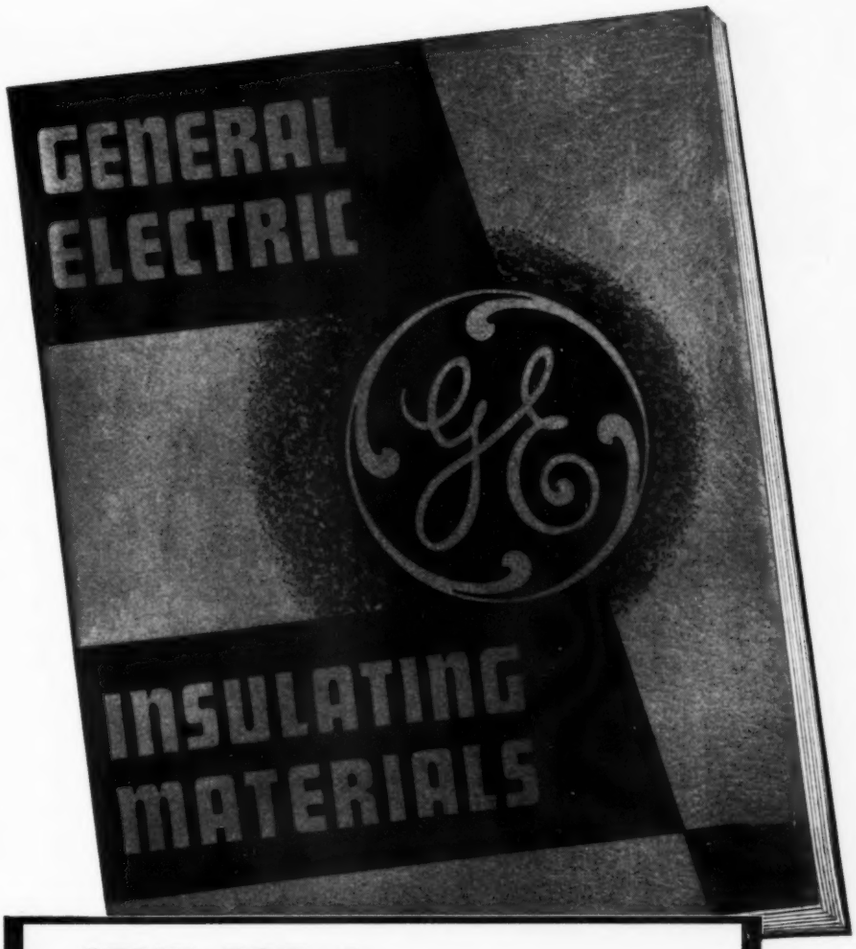
MOTOR CARAVAN FOR ROCKY MT. A.W.

An all-out program for the promotion of Adequate Wiring has been perfected by the A.W. Bureau of the Rocky Mountain Electrical League. It has been designed so every citizen of Colorado, New Mexico, Wyoming and many in certain sections of Montana and South Dakota, will hear or see the A.W. story during the coming year.

To aid in this gigantic task, a motor caravan, headed by Chairman T. M. Foulk and a crew of assistants will visit various parts of the League territory to conduct meetings for local industry units.

Another feature of the 1941 program will be a monthly clinic for electrical contractors. Dinner meetings and conferences will be held for architects, building con-

ASSOCIATION MINDED Sylvan W. Drucker, president, Independent Wiring Co., Inc., Philadelphia, Pa., believes that in union there is strength. Mr. Drucker is a contractor member of the Board of Governors of the Electrical Association of Philadelphia.



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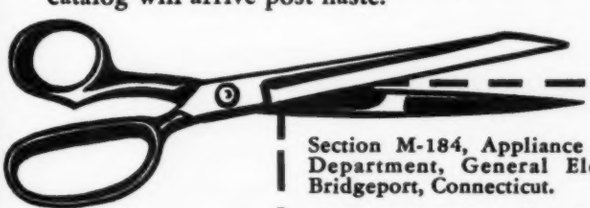
You'll get a lot of help from this large, attractive, well-indexed G-E Insulating Materials Catalog.

There's almost nothing in electrical insulating materials that you can't find in it. The General Electric line is COMPLETE.

Plenty of pictures to make it interesting and informative.

Just use this coupon. Your copy of this fine catalog will arrive post haste.



Section M-184, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

You can send me that Insulating Materials Catalog right now!

Name .....

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GENERAL ELECTRIC

P&S
WIRING DEVICES

A WEATHERPROOF SWITCH & OUTLET COMBINATION for Single Gang Installation

Cat. No. 4526

A thoroughly weatherproof installation in half the space usually required.

10 Ampere T-rated Single Pole Switch — may be interchanged with other P&S-Despard switches in your stock for D.P., 3-W or 4-W installations.

Convenience Outlet has contacts which grip both sides of cap blades.

Each device sealed with cover and plate gaskets.

Switch and outlet conform to Federal Specifications W-S-893 and W-R-151.

Sold Through Electrical Wholesalers

Catalog on Request

Pass & Seymour, Inc.
SYRACUSE, N. Y.

In the News

[FROM PAGE 95]

tractors, managers and engineers and others. Radio, newspapers, billboards, pamphlets, stickers, letters and public talks by women and men will round out the media through which the A.W. story will be transmitted. The Denver Electric Institute, a League adjunct will be the chief informational service center.

CHICAGO JOURNEYMEN TO STUDY SPLICING

Special instruction in high tension cable splicing will be given at the Washburn Trade School, Chicago in a class for journeymen electricians under the auspices of the Chicago Electrical Contractors Association and I.B.E.W. Local 134.

In connection with the announcement, Secretary J. Walter Collins of the contractor group stated that all available cable splicers in the area are now over 60 years of age and a serious shortage is threatening.

New facilities in the trade school will include instruction in welding for electricians and apprentices.

—WITH THE— *Manufacturers*

General Electric Company has appointed C. I. MacGuffie as Manager Sales, Electric Welding Section. Mr. MacGuffie succeeds L. D. Meeker, now associated with the Smith-Meeker Engineering Co., New York City.

•

Johns-Manville has opened a new industrial department office in Atlanta, Ga. The new district will serve the states of Georgia, Tennessee, North Carolina, South Carolina, Florida, Alabama and Mississippi. This office is headed by Thomas J. Roberts, formerly assistant to T. K. Mial, vice-president.

•

Westinghouse Electric & Manufacturing Company will move into its new offices at 40 Wall Street, New York, on April 15. The departments to be moved to the new headquarters include Eastern District Apparatus Sales Division; Westinghouse Electric International Co. and the New York executive departments of the company.

Monarch
Your Best Choice for-

MON-O-LAG RENEWABLE FUSES

● Quality workmanship and materials identify *all* Monarch Fuses. Of simple but sturdy construction, it's easy and quick to renew. Completely approved in all sizes and both voltages.

Monarch renewable fuses comply with Federal Specifications.

Monarch
FUSE COMPANY, INC.
JAMESTOWN, NEW YORK

BADGER
Synchronous
ELECTRIC TIME SWITCHES

CONTRACTORS LIKE THEM BECAUSE:
they are dependable and easy to install

USERS LIKE THEM BECAUSE:
of economical operation and low cost

The Badger line of Time Switches is always in demand by Contractors who want dependability, accuracy, and the right type for a specific need. They know from experience that this is the line that gives them successful, profitable installations. They know when they install Badger Synchronous Electric Time Switches for their customers they are giving them complete satisfaction—accurate timing, economical operation, dependable service. You can't go wrong on Badger. Write for more particulars or see your Wholesaler.

RELIANCE AUTOMATIC LIGHTING COMPANY
1937 MEAD STREET RACINE, WISCONSIN

Allis-Chalmers Mfg. Co. has made A. A. Dahms manager of the Davenport, Iowa branch office. Prior to this appointment, Mr. Dahms was connected with the company's Chicago office. He will be assisted in his new work by E. A. Rensch and C. J. Schutty.

•

Cutler-Hammer, Inc. has recently moved the Indianapolis Sales Office to 241 N. Pennsylvania Street.

•

John A. Roebling's Sons Company of Trenton, N. J. has appointed Ernest C. Low as general manager of sales. Mr. Low will make his headquarters at Trenton.

•

Mitchell Manufacturing Company, Chicago, announces the appointment of Jack Neuhauser as sales representative in Illinois and Southern Wisconsin. Mr. Neuhauser was formerly with the Commonwealth Edison Company.

•

Smoot-Holman Co., Inglewood, Calif. has moved its San Francisco offices to 460 Seventh St. Gale F. Thomas is the San Francisco district manager.

•

The Lincoln Electric Company, Cleveland, announces the appointment of Stewart J. Hieronymus as sales engineer with its San Francisco office.

•

The Philadelphia Branch of the **Independent Pneumatic Tool Co.** has moved into a new building at the corner of 17th and Fairmount Avenues.

•

American Lava Corporation, Chattanooga, announces the appointment of S. J. McDowell to its engineering staff. Mr. McDowell will have charge of production.

•

Trade-Wind Motor Fans, Inc. of Los Angeles, Calif. has moved to larger quarters at 5725 South Main Street.

•

Allen B. DuMont Laboratories, Inc. announces the appointment of the H. E. Ransford Company, Fulton Building, Pittsburgh, Pa. as sales representative for Western Pennsylvania and the state of West Virginia.

INTRODUCING THE
VERSITAP
ONE CONNECTOR
FOR USE AS A TEE, LINK, CROSS OR PARALLEL CLAMP...TAKES WIDE RANGE
AT LAST SOMEBODY WORKED IT OUT... HIGH ADAPTABILITY, LOW PRICE!
Keeps connector stocks small . . . Installed with a wrench, compact . . . Prevents cable bending on offset taps . . . High strength, conductivity copper alloy . . . Ten sizes cover any of 814 joints.
TYPE QPX
PAT. PEND.
1—Bottom plate encloses bared section of run.
2—Bolt threads caught, tap is inserted.
3—Tightening two bolts completes the joint.
HAVE YOU CATALOG 41?
—for copies write to
BURNDY ENGINEERING CO., INC.
459 East 133rd Street, New York City.
A SINGLE VERSITAP HANDLES THESE CONDUCTOR SETUPS
SEE YOUR WHOLESALER ABOUT
BURNDY
CONNECTORS

YOU GET ALL THREE with a BLACKHAWK Pipe Bender

Blackhawk Benders do MORE than bend pipe. They include a Porto-Power Hydraulic Unit that can be used separately from the bending attachments. Here is the triple utility:

1 PIPE BENDING

Smooth, remotely controlled hydraulic power bends rigid conduit and pipe up to 4" diameter. Saves need for elbows and couplings and otherwise necessary cutting and threading.

2 MAINTENANCE AND PRODUCTION

Big range of attachments adapt the hydraulic unit to push, pull, bend, press, spread and clamp work. Pull gears and pulleys, lift machinery, (as shown at left)—do scores of other jobs allied to pipe bending.

3 SPECIAL JACK

Compact 10 or 20-ton ram (same as used in pipe bending) works in all directions — and at any angle. Preferred to all other types of jacks.

MAIL COUPON TODAY

BLACKHAWK MFG. COMPANY
Dept. 2041, Milwaukee, Wis.

Send Full Information on your Pipe Benders.

Name.....

Company.....

Address.....

More Gossip

Code School in New Orleans

A series of 12 meetings for electrical contractors and inspectors to study the 1940 National Electrical Code is being conducted under the auspices of the Louisiana Chapter, International Association of Electrical Inspectors.

B. Z. Segall, of the New Orleans Public Service Company is the instructor and discussion leader. Meetings are held in the utility company's auditorium each week.

BIRD LOVER Vernon M. Miller, president of the Miller-Liskey Electric Co., Hagerstown, Md., takes time from his duties as estimator and general manager of the company to head the activities of the National Hungarian Pigeon Association. Vernie, as he is known to his friends, is also an active member of the City Council and a director and member of the Executive Committee of the Electrical Contractors Association of Maryland, Inc.

Larger Quarters For Bauer & Co.

Bauer & Co., electrical contractors located for the past 25 years at 440 Asylum St., Hartford, Conn., have recently acquired a two-story and basement modern building at 844 Windsor St. in the same city. The new building into which the company will move in the near future, contains about 21,000 square feet of space, more than twice that of the present location.

New Name

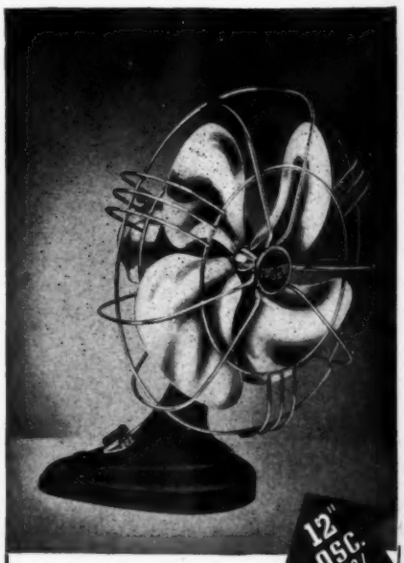
The electrical contracting firm of Josephson & Zimmerman, operating for more than 27 years in Kenosha, Wisc., has recently changed its name to Josephson & Thomey. Jacob Zimmerman, one of the original partners, has not been connected with the firm for more than a year.

WOLVERINE SOLDERING LUGS

- ***High-Conductivity***
- ***Square-End***
- ***Uniform Dimensions***

BUY FROM YOUR JOBBER

WOLVERINE TUBE CO.
DETROIT, MICHIGAN



Signal's 1941 fans embody the ultimate in Design-Quality-Price. Each fan is generously endowed with the eye appeal that commands attention, with important features that rate them real values. And all are in the popular price brackets. See your jobber now!

12" OSC. #361

SIGNAL ELECTRIC MFG. CO.
MENOMINEE, MICHIGAN
Offices in all principal cities

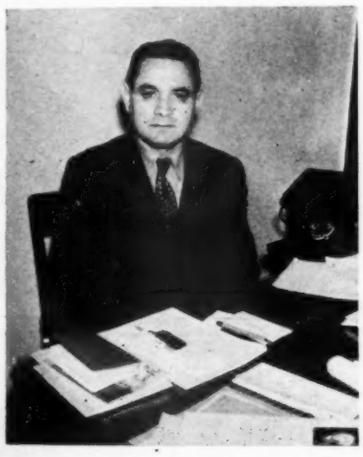
SIGNAL

San Francisco Club Director

Garth Chamblin, son of Clyde L. Chamblin, former N.E.C.A. president and a partner in the firm, California Electrical Construction Co., with his father in San Francisco was elected a director of the San Francisco Electric Club in March.

Cristal with Dingle-Clark

Charles W. Cristal, who has had seventeen years of experience in the electrical industry, has been appointed Sales Manager of the Electrical Construction Department of the Dingle-Clark Co., Contracting Engineers of Cleveland, Ohio. This company specializes in electrical construction for the heavier industries, particularly chemical and steel.



MUSIC AND BOOKS are favorite pastimes for the leisure moments of Morris Newmark, president of Morris Newmark & Bros., enterprising electrical contractors of Philadelphia. They provide relaxation from business cares, says Morris who is the proud uncle of four concert musicians who play with leading philharmonic orchestras.

Eklund's Answer the Bugle

National defense is taking its toll of contractors' staffs but few contractors are hit as hard as was H. R. Eklund of Eklund Electric Co., pioneer electrical contractor, San Rafael, Calif. His oldest son, Robert, associated in the firm as office manager and in charge of the store, was a lieutenant in the local Marine Corps reserves. In his company were a brother, Arthur, and two boys from the shop, Louis Ponti and Tony Palagreni. The call to duty came and drew all four from the shop. Quickly Harry Eklund brought his daughter into the firm for the bookkeeping and store; borrowed another son, Luther, from Westinghouse Supply Co. where he was employed as service and repair man. Later it developed that son Arthur had served enough of his enlistment and was released. So Eklund Electric Co. is back on a war footing.

CHICAGO TRANSFORMER

Approved BALLASTS sell installations

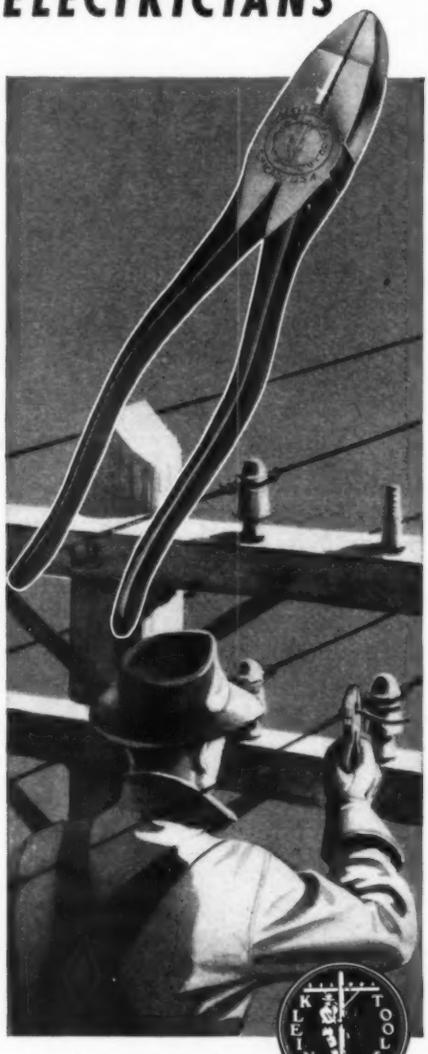
Backed by approval of leading laboratories and built to conform to the high standards set by Chicago Transformer itself, Chicago approved Ballasts are an assurance of better fluorescent lamp performance —a guarantee of customer satisfaction. Laboratory tests against standard reactors for heat tolerances, Watt delivery control, hum requirements, starting time . . . and for wave shape tolerances to minimize radio interference, are all aimed at creating satisfied customers for you when Chicago ballasts are used in installations. Illustrated are double 40 and starting compensator certified by E.T.L. Other numbers will be certified as produced. Write for new price list today.

CHICAGO TRANSFORMER

CHICAGO TRANSFORMER CORPORATION

3505 WEST ADDISON STREET • CHICAGO

KLEIN . . .
STANDARD WITH ELECTRICIANS



"Since 1857"

NO "pretty good" plier is good enough for the man who has to work with them every day. That's why electricians—everywhere—rely on Klein Pliers. They know that each pair must pass an individual test far in excess to any service in the field. They know, too, that every pair is individually fitted, tempered and adjusted—that Klein Pliers have been the standard—"since 1857."

Your copy of the Klein Pocket Tool Guide will be sent on request.

DISTRIBUTED THROUGH JOBBERS

Foreign Distributor:

International Standard Electric Corp., New York

Mathias KLEIN & Sons

3200 Belmont Avenue, Chicago, Illinois

More Gossip

Green Bay Contractors Elect Officers

At a recent meeting of the Green Bay Electrical Contractors' Association, Green Bay, Wisc., A. L. Peterson was elected president of the association succeeding L. P. La Haye. Other officers chosen include A. A. Bodart, vice-president; A. A. Allen, secretary-treasurer and H. A. Slattery, sergeant-at-arms.

STEADY EXPANSION is the reward for these enterprising members of Standard Electric Motor Repair Co., Linden, N. J. After being in their new quarters for only a short time, they are planning to enlarge the shop. (Left to right) Ted Kyak, shop foreman; Mathew Malinowski, president in charge of contracting; Stanley Bojak, vice-president in charge of repair work.

Indianapolis League Meets

The first annual meeting of the newly incorporated Electric League of Indianapolis was recently held in that city. The business session consisted of the presentation of committee reports of the activities of the past year and the election of officers and directors for 1941.

The officers include Dan C. Hess, Indianapolis Power & Light Co., re-elected president for another term; vice-president, C. S. Wheeler, Refrigerating Equipment Co.; secretary, H. W. Claffey, Sanborn Electric Co.; assistant secretary, C. F. Fitchey, G. E. Supply Corp.; treasurer, Ben Olsen, General Electric Co.; assistant treasurer, Walter Meyers, Walter Meyers Electric Service Company.

Newly elected directors representing the Contractor, Motor Repair and Maintenance Engineers Divisions of the League are respectively: H. W. Claffey, Sanborn Electric Co.; Paul G. Winter, American Electric Co. and T. C. Mauch, Indianapolis Water Company. Six additional directors representing the other branches of the electrical industry were also elected.

Following the business session a banquet and entertainment program were enjoyed by approximately 200 members and guests present.

For Quick Safe Permanent Connections Use

BAKELITE Safe—Strong. Wires hold firmly in Vee slot. One size for all wires.

Sherman FIXTURE CONNECTORS

You can rely on Sherman Connectors to make tight, permanent splices. Simply constructed for quick and easy handling. One size takes all wires commonly used. Ask for Bulletin No. 10 and free samples.

BRONZE High copper bronze for inside or outside use permanently insures against weather cracking. Non-removable screws.

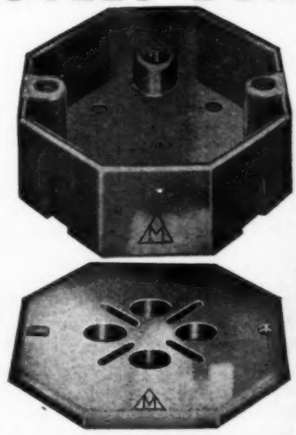
H. B. SHERMAN MFG. CO.
Battle Creek, Mich.

Profit by USING

ILLINOIS

Dependable Porcelain

OUTLET BOXES



★ Glazed and unglazed styles conforming to all existing standards of dimensions, spacing, position of knockout holes, and mounting screws. High mechanical and electrical efficiency.

Contractors who use these products not only establish themselves most securely with their customers but also build their business by making each job a true quality one. Send for bulletin.

ILLINOIS ELECTRIC PORCELAIN CO.
MACOMB, ILL.

Philadelphia E.M.E.A. Celebrates

The Electrical Maintenance Engineers' Association of Philadelphia celebrated 10 years of continuous activity under the sponsorship of the Electrical Association last month. The program, devoted entirely to enjoyment and sociability, included an anniversary dinner at the Hotel Philadelphian. Members of the Manufacturers' and Wholesalers' Divisions of the Electrical Association and the Power Maintenance Association of South Jersey were guests of the maintenance men.

Partners Separate

The electrical contracting firm formerly known as Odom and Pflueger of New Orleans, La., has dissolved and each principal has gone into business for himself. Mr. Odom operates under the name of D. T. Odom Electric Co., with headquarters at 629 Julia Street, New Orleans. Mr. Pflueger goes under the name of Pflueger Electric Co., with offices at 741 Saint Charles Street in the same city. Both specialize in the contracting branch of the industry.

Inaugurate Infra-Red Group

An Infra-Red Group of the Electrical Association of Philadelphia was recently formed in that city.

At the inaugural meeting representatives of The Fostoria Pressed Steel Corp., C. M. Hall Lamp Co., Lamp Department of the General Electric Co., Lamp Division of Westinghouse Electric & Mfg. Co. and the Philadelphia Electric Company, discussed the need for an educational activity in connection with infra-red equipment. A decision was made to develop and inaugurate a promotional program. C. E. Russell of the Philadelphia Electric Company was temporary chairman of the meeting.

CLOSE CONTACT between the shop and management facilitates cost control, according to Allen E. Ocker (right) manager of the Hagerstown Equipment Co., Inc., Hagerstown, Md., and C. A. Hoelle, superintendent of the motor repair department. Plenty of equipment and large stock of spare parts makes this one of the largest repair shops in this section of Maryland.

Perfect Performance

LLOYD STARTERS
Are Flawless in Action

They Assure

1. QUICK STARTING.
2. LONGER LIFE.
   Several times the standard specifications.
3. LONGER LIFE FOR THE LAMP.

FS-2 for 15 and 20-watt lamps.
FS-4 for 30 and 40-watt lamps.
Certified by Electrical Testing Laboratories Specification 6

FS-6 for 100-watt lamps.
All Starters Listed and Approved by Underwriters' Laboratories Inc.

Comb. Lamp Holder and Starter Socket Cat. 253 and 253-W

Separate Starter Socket for Remote Mounting With "Lobster Claw" Lock Cat. 352
Patents Pending

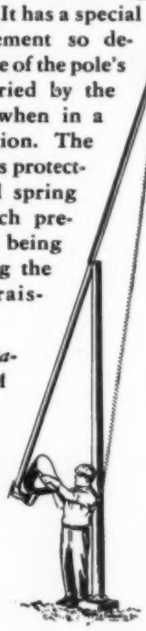
Starter Socket Cat. 252 With "Lobster Claw" Lock

LLOYD PRODUCTS COMPANY
Providence, R. I.
Representatives in 22 Leading Cities

This all-steel pole is designed for service station, industrial and all other floodlighting applications where maintenance by tower wagon is not practical or available. Replacing of bulb or cleaning of reflector is done easily by simply lowering the hinged upper section.

The unit will carry one or more floodlights having a total weight of 75 lbs. at a mounting height of 24 ft. It has a special hinge arrangement so designed that none of the pole's weight is carried by the hinge except when in a lowered position. The lighting cable is protected by a coiled spring protector which prevents it from being pinched during the lowering or raising operation.

Write for Catalog No. 70A describing this and many other floodlighting poles in the Monotube line.



THE UNION METAL MANUFACTURING CO.
CANTON, OHIO

More Gossip

Arnold & Co. Moves

The M. E. Arnold & Co., specializing in the installation and maintenance of electrical equipment for commercial and industrial establishments, moved from 1019 Cherry Street to its new headquarters at 1316 Walnut Street, Philadelphia, Pa.

The firm, which has been in the electrical business since it was founded in 1897, in addition to its contracting activities maintains a complete electric motor repair department and a recently established appliance repair division.

NEW PRESIDENT of the Electrical Contractors Association of Greater Boston, Inc., Albert Frank is also head man of Eastern Electric Co., Boston theatre and commercial wiring specialists. Al is well known to the electrical industry in the Hub City and is also on the State Board of Examiners for licensing electricians.

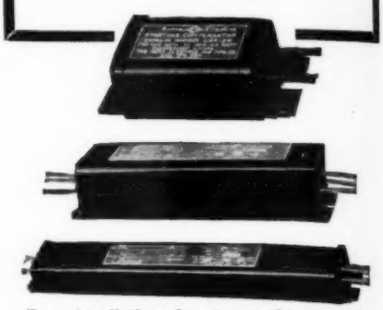
Wausau Inspections

A new ordinance, approved by the Common Council of Wausau, Wis., gives the electrical inspector authority to inspect the wiring in new buildings. Violators are subject to fines ranging from $1 to $50 or imprisonment up to 30 days.

Dumbaugh at New Address

The Dumbaugh Electric Repair Shop of Butler, Pa., has moved from its old location on Bantam Avenue to its new headquarters at 567 West Brady Street, near Mercer Street in the same city.

IMPORTANT
TO FLUORESCENT
LAMP PERFORMANCE



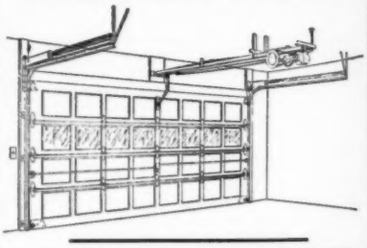
To gain all the advantages of better light and economy from fluorescent lighting be sure that the lamps you install are controlled with Acme ballasts. Acme engineered ballasts are designed to the exact current limitations of the lamp, (as example supply the exact wattage required by each lamp in dual lamp installations,) and audible magnetic hum has been minimized. To satisfy your customers specify or standardize on Acme Fluorescent Lamp Ballasts. 62 separate styles and types. Acme ballasts carry Underwriters' Laboratories seal and are guaranteed.

Write for bulletin 153

THE ACME ELECTRIC & MFG. CO.
36 WATER ST. • CUBA, NEW YORK

Acme Electric
TRANSFORMERS

OVERHEAD DOOR OPERATORS



1941 ELECTRICAL BUYERS REFERENCE

Doors and Operators, Inc.
Tiffin, Ohio 528 Hudson St.

DRILL CONCRETE
the Easy Way

The old arm and hammer method is slow, hard and expensive. Use the Wodack "Do-All" Combination Electric Hammer and Drill and drill 15 times as fast in concrete and masonry. Two tools in one. With hammer member removed it's an electric drill with ½" chuck. Cuts cost of drilling for expansion anchors. Universal motor 110 or 220 v. Ask for Bulletin.

WODACK ELECTRIC TOOL CORP.
4628 W. Huron Street - Chicago, Ill.
Phone AUSTIN 9866

Chattanooga Contractor Expands

McKenzie-Duncan, Chattanooga, Tenn. electrical contractors, moved into new quarters in March. The new location provides additional space and facilities for the firm's neon plant, supervised by W. H. Ashmore and a line of electrical appliances in charge of Chuck Taylor.

Knew All the Answers

J. D. Lynett, chief electrical inspector, City of New York; Paul Ferneding, New York Board of Fire Underwriters; W. R. Rauth, Electrical Engineering Dept., College of City of New York; and Arthur Scala, Consolidated Edison Co., of N. Y., took on all comers in a quiz session recently held by the Independent Electrical Contractors Association, Inc., of New York City.

These experts, under the guidance of Jos. Donnath acting as master of ceremonies, disposed of all questions relating to the City and National electrical codes, ranging from outlet boxes to 2000-amp. switches. The contractors really learned what they could and could not do. There was so much interest evidenced that the meeting had to be forcibly adjourned to prevent an all-night session.

Continuous Air Conditioning

Automatic air conditioning for 24 hours a day operation was recently installed in the Davenport Hosiery Mill at Chattanooga, Tenn. The Reeve Electric Co., using Carrier equipment, made the installation, claimed to be the first of its kind in a hosiery mill.

The installation totals 497 hp. and maintains a temperature of 80 deg. and a humidity of 50 per cent over a floor area of 68,400 sq.ft. The building is 90 by 190 feet and 70 feet high. Incoming air is purified through an oil and high voltage air filter.

LIGHTING is becoming an important specialty with more electrical contractors as foot-candles keep going up. The Gamp Electric Company of St. Louis features lighting conspicuously in a fluorescent lighted sign. Their headquarters include an elaborately equipped fluorescent lighting demonstration laboratory.

Solve numerous wiring problems... install reasonably priced, high quality

LATROBE

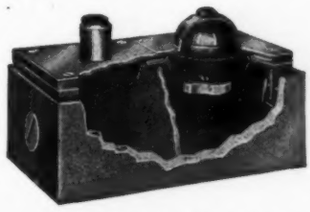
FLOOR BOXES *and* WIRING SPECIALTIES

Often the rewiring of existing buildings, and new wiring installations in new homes, presents certain problems of wiring layout and location . . . *problems that can be solved through the use of LATROBE Floor Boxes and Wiring Specialties.* Their scientifically planned construction equips them to fit the many increased needs of modern wiring fixtures . . . high standards of quality mark their manufacture . . . time consumed installing them is cut to a minimum through specialized design. And, their long life and flexibility are features that should appeal to your customers.

Get information on the complete LATROBE line. Discover how it can save you money by solving difficult wiring problems . . . and at the same time bring completely satisfactory service to your customers. Our latest literature will be sent you immediately upon request. *Write for it!*

NO. 130 ADJUSTABLE WATER TIGHT FLOOR BOX

No. 130 Box with No. 207 Bell Nozzle. Cutaway view illustrates how tapered unit receptacle fits tapered opening in adjustable ring. Cover plate 3½"—overall height 3½".

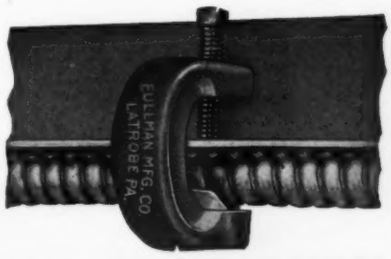


NO. 252-R TWO GANG BOX

Adjustable Floor Box with No. 208 Receptacle in one section. Cover plates have ½" and 2" flush brass plugs.

NO. 110 NON-ADJUSTABLE WATERTIGHT FLOOR BOX

Cutaway view shows how tapered unit receptacle fits tapered opening in top of box body. The latest in design, appearance, and simplicity of installation.



480 "BULLDOG" ARMORED CABLE SUPPORT

A light weight, strong, clamp for supporting or hanging cable. Permits hanging from any angle. The easiest and most economical method of temporarily or permanently installing armored cable in buildings of steel construction.

FULLMAN

MANUFACTURING CO.

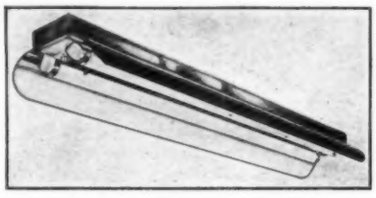
Headquarters for quality Floor Boxes and Wiring Specialties.

LATROBE PENNA.

EQUIPMENT NEWS

Industrial Fixture

The "Super Two Hundred" is a new industrial fixture for two 60-inch, 100-watt fluorescent lamps. It is available as standard open end unit with and without apertures, and as a closed end unit with fill-in sections for continuous installations. It is available for chain or pipe suspension. It has a porcelain enameled reflector. A ⅞-in. knockout is provided in both sides of hood for installation of pull-chain switch. It is wired with sockets, lamp starters and Tulamp ballast for either 110–125, 199–216 or 220–250 volt, a.c. operation. Day-Brite Lighting, Inc., 5411 Bulwer Avenue, St. Louis, Mo.



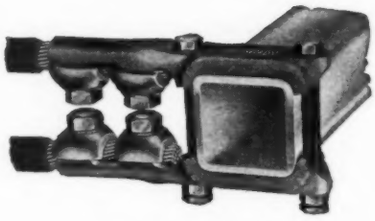
DAY-BRITE INDUSTRIAL FIXTURE

■

Fiber Anchor

A new and improved woodscrew anchor fabricated from a specially treated fiber has been developed. Due to its braided construction, this new anchor is claimed to have greater holding strength and to expand uniformly, without tearing, under screw pressure. It is chemically treated to withstand temperature changes and to protect against moisture. For use in lath and plaster, marble, tile, slate and fragile composition materials in new installations and in bushing existing screw holes. Available in 40 different diameters in lengths from ⅜-in. to 3½-in. The Paine Company. 2961 Carroll Ave., Chicago, Ill.

PAINE FIBER ANCHOR

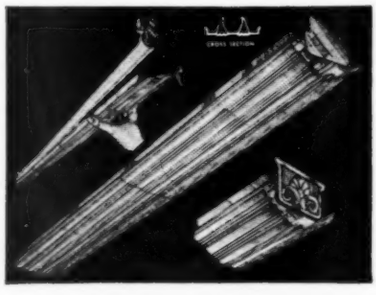


BURNDY CABLE TAP

Cable Taps

Type N2QTT connector is for use with square tubular bus. A double cable tap is used to join two 500 MCM cables to 3-inch square tube. The clamping elements on cables are located to provide a minimum of bulk. This connector and other types of square tube connectors are available for all sizes of square tube and for various conductor combinations. Burndy Engineering Co., Inc., 459 East 133d Street, New York, N. Y.

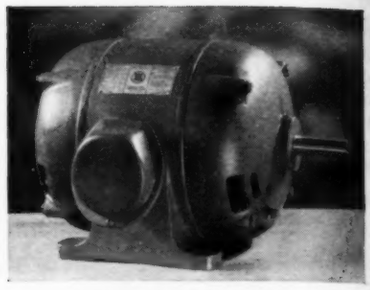
■



GUTH DIFFUSING STRIPS

Fluorescent Lighting

"P-F-C" plastic diffusing strips snap on fluorescent lamps. Available in 12- and 24-in. lengths and for use where T-12 (1½-in.) lamps are used in open type fixtures. Strips reduce lamp brightness 30 per cent and are made of shatter-proof plastic. Furnished in white, pink or yellow. White strip is used on general illumination applications for eye ease. Yellow with white lamps and pink with daylight lamps. Edwin F. Guth Company, 2615 Washington Ave., St. Louis, Mo.



WESTINGHOUSE CS MOTOR

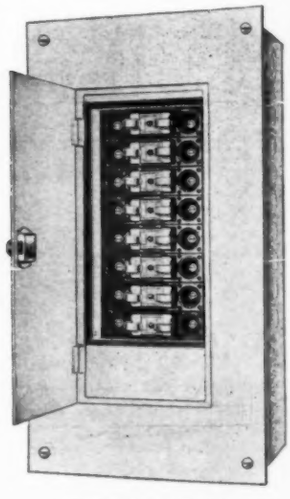
Induction Motors

New smaller a.c. squirrel cage ball-bearing induction motors designed for general purpose industrial, machinery drive applications have been developed. Available in ratings from ½ to 5 hp., with speeds from 875 to 3600 r.p.m., for operation on 110, 220, 440 and 550 volts, 2 and 3 phase. Motor has "Permanently Sealed" ball-bearing which requires lubrication only once every three years. Plastic wire coating gives maximum dielectric strength, toughness and flexibility. Reinforced cuffs at slot edges protect windings from abrasion. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

■

Panels

These "NTP" panels with push-pull switches for individual circuit control are for flush and surface mounting. Available in 4 to 40 circuits incl. Service is 3-wire and 3-phase 4-wire. Branches are 2-wire, single (plug) fusing. Switches are 30 amperes, 125 volts, single pole. Box is steel and can be installed with main lugs at top or bottom. Door for panels up to 12 circuits have spring catch, 16 circuits and larger, spring lock and two keys. Flush type furnished with angles and brackets for quick mounting to studding. The Wadsworth Electric Mfg. Co., Covington, Ky.



WADSWORTH PANEL

THE MOTOR YOU ASKED FOR IS STRONG ON PROTECTION

New G-E TRI-CLAD MOTOR

1

Extra Protection

AGAINST PHYSICAL DAMAGE

A truly modern motor must withstand accidental blows, flying chips, dripping liquids, and occasional bumps in moving or mounting. We built the Tri-Clad motor to meet such threats of damage!

We made the frame and end shields of cast iron, using channel and rib sections for strength without excessive weight or bulk; we cast the sturdy, rigid feet integrally with the frame. We completely enclosed the upper portion and carefully baffled all ventilating openings to protect vital motor parts. The bearings have dust-tight cast-iron housings. And the finishing touch—we gave the motor a tough coat of paint to protect against rust and corrosion.

The Tri-Clad motor is fully protected against the accidental ill-treatment some motors encounter all the time, and which *all* motors encounter some of the time. As a safeguard against production interruptions, as a prime factor in lowering costs, this new motor means extra profit protection, too.

Make your next induction motors Tri-Clad. General Electric, Schenectady, N.Y.

BUILT FOR PROTECTION FIRST . . . . . TO LAST

2

Extra Protection

AGAINST ELECTRICAL BREAKDOWN

New stator windings of Formex wire give extra protection internally against moisture, oil, abrasion, and heat aging. New synthetic impregnating and protecting varnishes make a rigid unit with a hard finish.

3

Extra Protection

AGAINST OPERATING WEAR AND TEAR

Sleeve bearings of new design have long life and great load capacity because of new proportions and oil distributing system. The one-piece cast-aluminum rotor winding, with fans cast integrally, is practically indestructible.

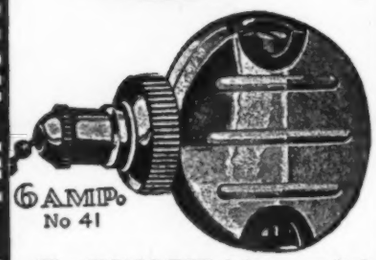
GENERAL ELECTRIC

750-49-8058

Levolier

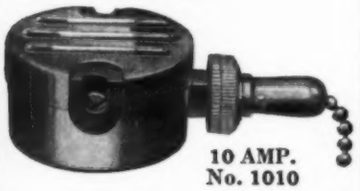
SWITCHES

FIXTURE CANOPIES · CONDUIT BOXES · FHP MOTORS



6 AMP.
No 41

The SMALLEST 6-Amp. switch on the market now has a "T" rating! Same price . . . same size, but now under the Underwriters' "T" rating the No. 41 Levolier Switch will take the initial surge of 48 Amps. from a cold, Type C lamp, eight times its rated capacity—(6-Amps., "T," 125 Volts; or 3-Amps., 250 Volts). With further improvements, this sturdy little switch has been made even more rugged. Used on small power apparatus and for individual control of lighting fixtures in industrial plants, commercial institutions and public buildings.



10 AMP.
No. 1010

The McGILL Levolier No. 1010 Switch shown above is designed for heavy duty 10-Amp. service. Listed by UL under the "T" rating, this single pole type is designed expressly for safe, positive control of modern high watt and high intensity lamps. Also adaptable to a variety of other uses. Equipped with plain levers, fibre levers or cord controls. Order these switches from your jobber—his stock is complete!

(Listed by Underwriters' Laboratories)

McGILL MANUFACTURING CO.
Electrical Division
VALPARAISO, INDIANA

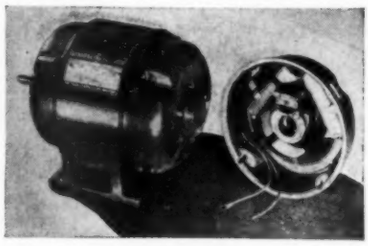
McGILL

EQUIPMENT NEWS

[FROM PAGE 104]

Capacitor Motor

A new Tri-Clad capacitor motor designed for industrial applications has been added to this line of polyphase induction motors. May be obtained with either ball-bearing or sleeve-bearing construction and is available in two types, Type KC and Type KCJ. Type KC is designed for applications requiring moderate starting torques such as fans, blowers and centrifugal pumps. Type KCJ is designed for compressors, loaded conveyors, reciprocating pumps and other applications requiring high starting torque. These motors incorporate all the protective features of the Tri-Clad line. General Electric Co., Schenectady, N. Y.

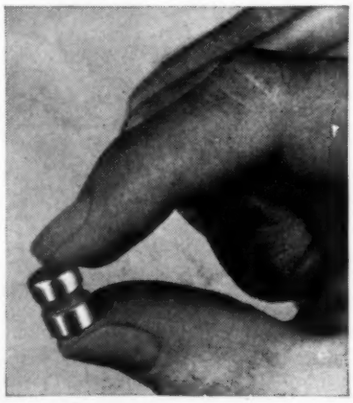


G-E TRI-CLAD CAPACITOR MOTOR

■

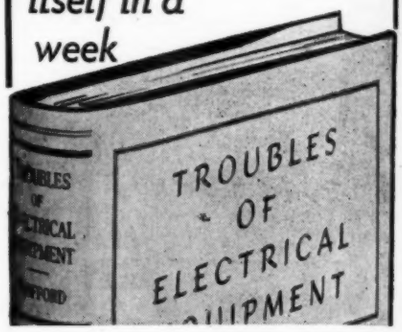
Mercury Switches

A new all-metal mercury switch known as "Tipit" switch. Has a capacity of ½ ampere at 24 volts to 4 ampere at 6 volts. It is recommended for use in explosive atmospheres and on electrical machinery. It mounts in small holder with screw stakes for terminal connection. Assembly is attached to door, lid or other movable member; the movement actuating the switch. Operates on a tilt of 20 degrees or more. Durakool, Inc., 1010 N. Main Street, Elkhart, Ind.



DURAKOOL MERCURY SWITCH

A trouble-shooting tool—*that will pay for itself in a week*



- **SHOWS HOW TO QUICKLY LOCATE** motor troubles—transformer troubles—circuit breaker and relay troubles—troubles of lightning arresters—insulation troubles—voltage-regulator troubles—cable troubles.
- **SHOWS HOW TO DIAGNOSE THEM ACCURATELY**
- **SHOWS HOW TO CORRECT THEM**

This book brings you in compact, usable form practical pointers and trouble charts that you will use the first day you get the book in your hands.

TROUBLES OF

ELECTRICAL EQUIPMENT

Their Symptoms, Causes and Remedy

By H. E. Stafford
Consulting Engineer

JUST OUT

New 2nd Edition Revised and Enlarged

373 pages, 6x9, 330 illustrations 25 tables, $3.00

This book covers the symptoms, causes and remedy of troubles of both a-c and d-c apparatus usually found in the average industrial plant. Includes priceless practical hints on efficient operation and maintenance. A practical, how-to-do-it book that is an indispensable job manual for the electrical maintenance man. All formulas illustrated by practical examples and all technical terms explained in everyday English.

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(Books sent on approval in U. S. and Canada only.)

Fluorescent Lamp

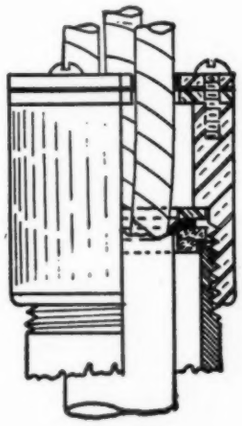
A new "Soft White" fluorescent lamp has been added to this line. The new color has a slight pinkish tinge. It is recommended for use in the display lighting of meat products, food products, beauty parlors, hotels, restaurants, night clubs, cocktail lounges and theater lobbies. Available in 15-, 18-, 24-, 36- and 48-in. lengths. Hygrade Sylvania Corporation, Salem, Mass.

HYGRADE FLUORESCENT LAMP

■

Fittings

These cable end sealing devices are used at switchboards, cabinets, pull boxes, switches or free pipe terminals. Series 100 and 200 are for service up to 750 volts, a.c. or d.c. For upright mounting only and single or multiple conductor lead covered cable in conduit. Series 100 is without cover and 200 with cover. The Adalet Manufacturing Company, 1448 East 49th Street, Cleveland, Ohio.



ADALET FITTING

■

Fluorescent Lamp

The new 36-inch mazda fluorescent lamp, rated at 65 watts, is designed for use in commercial fields. Like the 100-watt F lamp, the new 65-watt uses a tubular bulb 2⅛-inches in diameter. Available in 3500-degree white and daylight. Can be used as a supplementry light source in various industrial operations but particularly suitable for specialty shops; department stores; small stores; offices; hotels; restaurants; theaters and clubs. General Electric Co., Nela Park, Cleveland, Ohio.

3 EASY STEPS TO NEW PROFITS

1 ORDER ILGETTE KITCHEN VENTILATING FAN FROM YOUR DISTRIBUTOR

2 GET FREE! DEMONSTRATING DISPLAY FOR WINDOW OR COUNTER . . . STORE OR HOME DEMONSTRATIONS

3 GET THIS COMPLETE KIT OF SELLING HELPS FREE!

ILG PLAN BOOK
16-page, colorful, spiral-bound. "Chock-full" of practical selling ideas.

SALES LITERATURE
Sales manual and catalog materials to help your salesmen become record-breaking ventilation experts.

CONSUMER BOOKLETS
12-page, 3-color, for mailing or handing to prospects. Helps get the signature on the dotted line.

BILL INSERTS
for enclosure with bills, correspondence and packages, or for hand-out. Single sheet, adds no postage.

STORE POSTER
Big (25x38") 2-color, —use on wire, on wall, in window in store.

WINDOW DECAL
3-color, ready to apply on window or door glass. Ties up your store with ILG national advertising.

ILG Vitalized VENTILATION AND AIR CONDITIONING
AIR CHANGE...NOT JUST AIR MOVEMENT!

NATIONALLY ADVERTISED IN TIME
Every ad reaches over 800,000 able-to-buy families. Year 'round program keeps ILG name in front of *your* prospects, refers inquiries to *you!* Tie-in and *cash*-in!

ILG ELECTRIC VENTILATING CO.
2879 N. CRAWFORD AVE., CHICAGO, ILL.
Offices in 43 Principal Cities

THERE ARE PROFITS IN AIR CONTROL!

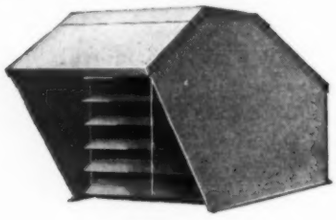
Stop Losses from stale air in Factories, Offices and Stores with

REX AIRATE

COMFORT VENTILATION

MODEL SK—EXHAUST UNIT

Fresh air in motion cuts production costs for the manufacturer by eliminating worker fatigue and error caused by stale air. Air circulation helps the managers of stores and restaurants to increase sales by providing more desirable and healthful conditions for patrons.



ROOF MODEL

In the REX-AIRATE line are the widely adaptable SK models, the Roof Model, Floor Circulators, and Window Ventilators. REX-AIRATE features include:

Belt drive for quiet running
All-steel construction
Full range of sizes
Reliable capacity ratings

Another *fast-selling REX-AIRATE* unit is the "Attik-Pak"—a *complete package* attic ventilator for homes.

WRITE TODAY for the booklet "Comfort Ventilation" and for full details on our money-making line.

Air CONTROLS INC.

Div. of The Cleveland Heater Company
1935 West 114th St.,
Cleveland, Ohio

EQUIPMENT News

[FROM PAGE 107]

Instrument

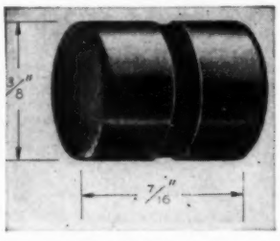
An instrument for testing fluorescent lighting fixtures and auxiliaries, known as DACO Fluortest Junior. It is designed for testing any fluorescent fixture, from 15 to 100 watts, either a.c. or d.c., by removing lamp and plugging in an adaptor in both lamp sockets of the fixture. After plugging in adaptors, easy reading of instrument indicates line voltage, lamp operating voltage indicated in watts, condition of reactor, compensator and starters. Models also available for testing airplane fluorescent equipment. Dayton Acme Co., 2339 Gilbert Ave., Cincinnati, Ohio.

DAYTON TESTING INSTRUMENT

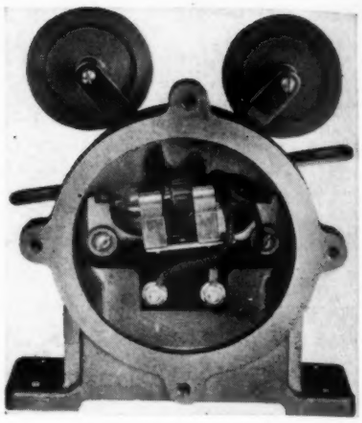
■

Mercury Switch

This midget mercury switch is designed for use in low voltage circuits up to 25 volts a.c. or d.c. and currents up to 10 amperes at 6 volts and 3 amperes at 25 volts. It measures $\frac{7}{16}$-in. in length by $\frac{3}{8}$-in. in diameter. It is claimed that a newly designed baffle device assures positive "make or break" operation, with no opportunity for flickering action when equipment is jolted. For use on thermostat circuits, radio door lights, telephone circuits, indicator circuits, Littelfuse, Inc., 4748 N. Ravenswood Avenue, Chicago, Ill.



LITTELFUSE MERCURY SWITCH



AUTOMATIC FLOAT SWITCH

Float Switch

Type J float switch uses a snap action mercury contactor and is built of noncorrosive materials. It comes complete with bracket for wall mounting, plus two wood screws and two expansion shields. It may also be used on a pipe for floor mounting using a U-bolt. Float, counterweight and cable are also included. Type JS is an explosion proof switch and built under Class I, Group D, explosion-proof enclosures. Automatic Control Company, 1005 University Ave., St. Paul, Minn.

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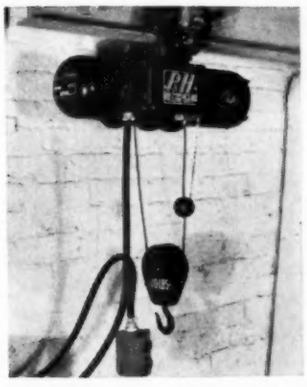


HARNISCHFEGER ELECTRIC HOIST

Hoist

This electric wire-rope hoist, known as P&H Zip-Lift, is designed for flexible handling service in all lines of industry. It can be mounted rigid or on hook or trolley, with mounting interchangeable when desired. It operates with push-buttons and is powered from an ordinary light circuit. Some of the features are double brakes, automatic limit switch and fully enclosed construction. It is recommended for raising and positioning parts on machine tools, for handling heavy loads on delivery platforms or in storage rooms and for interdepartmental transporting of materials. Available in 250, 500, 1000 and 2000 pound capacities. Harnischfeger Corporation, Milwaukee, Wis.

Fluorescent Fixture

Two new fluorescent fixtures have been developed for commercial use. Model 2027 uses two 40-watt, 48-in. fluorescent lamps and 2028 employs four such lamps. Overall dimensions are 49-in., width 8⅛-in., height 4¼-in. for the two lamp and width 1½-in., height 5½-in. for the four lamp. Operates on 110- to 125-volt, 60 cycle, alternating current. Mitchell Manufacturing Company, 2525 Clybourn Avenue, Chicago, Ill.

MITCHELL FLUORESCENT FIXTURE

■

Electric Drill Attachment

The Kett Universal is an attachment for electric drills used by electricians, maintenance men and plumbers. It is available in five sizes. Large size will drill holes up to 2 inches at any set angle. The next size is for use by electricians and will bore holes up to 1¼-inch. This is also telescopic. Can bore holes in joists in ten foot ceilings while standing on floor. Also three attachments for use on ¼-in. electric drills for small maintenance work. Can be attached to drill in three minutes. It is claimed to drill in 360 degrees of angles at any plane and will work in restricted spaces in which it has been impossible to operate an electric drill. Kett Appliance Company, Union Central Building, Cincinnati, Ohio.

KETT UNIVERSAL

TRANSITE CONDUIT installation in N. Y. State Education Bldg., Albany, N. Y. Terminal box built of flat Transite sheets. Couplings shown specially designed for this job. *Electrical Contractor:* J. M. Stanley, Albany.

USE

J-M TRANSITE DUCTS

Light in weight, easy to handle and assemble, these durable, asbestos-cement ducts save time and money on every job

Every feature of Transite Ducts is designed for true economy. Their light weight means easier handling, lower costs. You save on assembly, for the Harrington Couplings eliminate screwing or threading . . . go together quickly . . . drive up tight. Transite's slick, smooth bore provides rapid, easy cable pulls. Maintenance is minimized for Transite Ducts are made of asbestos and cement. They can't burn or rot, effectively resist corrosion, end condensation troubles.

For full details, write for brochure DS-410. Johns-Manville, 22 East 40th Street, New York, N. Y.

JM Johns-Manville

TRANSITE DUCTS

TRANSITE CONDUIT . . . for exposed work and for installation underground without concrete encasement.

TRANSITE KORDUCT . . . for installation in concrete. Thinner walled, lower priced, but otherwise identical with Transite Conduit.

DEALERS-Sell
TORK
CLOCKS

TURN ANYTHING ELECTRICAL
ON AND OFF REGULARLY

Four
Little
Giant
Models

Self-Starting

Ratchet Setting Dial; One Minute Accuracy; Hinged Cover; Lots of Room; 12 Knock-outs; 1 R.P.M. Indicator

191 A—Single Pole, 20 Amp. $12.00
1191 —Single Pole, 35 Amp. 15.00
962 A—Double Pole, 20 A. ea. 14.00
1962 —Double Pole, 35 A. ea. 15.00
Apt. House, 2-S.P. Circuits 22.50
Sixty Minute and Four Hour Timers

DEALERS PROFIT
Single 30%
2 or more.....35%

CARRIED BY
JOBBERS
EVERYWHERE

The Tork Clock Co. Inc.
MOUNT VERNON, NEW YORK

NEW { Designs
Values
Features

KAYLINE
fluorescent
LIGHTING

for your
Commercial-Industrial Installations

THE KAYLINE
"Fluo-Moderne"

The unit above is one of the many manufactured by KAYLINE that allow you a wide choice of both Industrial and Commercial fluorescent units.

WRITE TODAY FOR CATALOG AND ATTRACTIVE CONTRACTOR PRICES

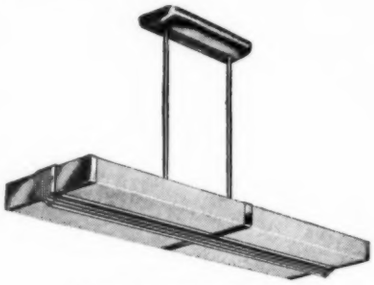
THE KAYLINE COMPANY
2480 E. 22nd St. Cleveland, Ohio

EQUIPMENT News

[FROM PAGE 109]

Fluorescent Fixture

A new fluorescent lighting fixture, known as "Panelex" is designed for commercial use. It uses "Louverglas," which is non-inflammable, flexible and will not shatter. Panels enclose fixture, making it dust tight. All wiring and operating auxiliaries are concealed. Stem pendants may be increased in length when required. It uses four 40-watt fluorescent lamps and equipment with Tulamp auxiliaries. It is for use on 60 cycle a.c. circuits. The Miller Company, Meriden, Conn.



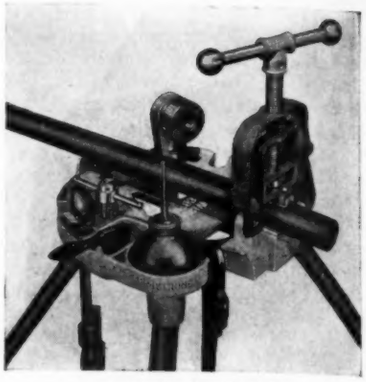
MILLER PANELEX FIXTURE

■

Instrument

The new Standco Universal type hand tachometers cover a wide range and come in four standard range combinations, covering speeds between 30 and 48,000 rpm. Instruments have rotating gear shift in knurled cover for changing to five speed ranges; have knife-edged pointers; three-inch diameter dial and open, easy-to-read scales. They are direct reading and no calculations are necessary to measure rpm. and fpm. Herman H. Sticht Company, 27 Park Place, New York, N. Y.

STICHT TACHOMETER



ARMSTRONG VISTAND

Vise Stand

This heavy-duty No. 933 Vistand is designed for either portable or stationary use. It has spreads of 50-in. in front and 43-in. from front to rear leg. The platform measures 14-in. in both width and depth and includes tool notches and slots around rim, oilcan recess and special "dope" pot. Equipment includes three benders—one for ⅜-in. pipe, and reverse benders for ½-in. and ¾-in. pipe. Armstrong Mfg. Co., Bridgeport, Conn.

■

Lamp

A new type high-wattage industrial lamp has been developed. By using a weather-proof glass, it reduces the size of a 500 watt lamp to a 200 watt lamp and permits lamp to withstand thermal shocks when used outdoors. It uses a medium screw base. Other size industrial lamps up to 10,000 watts are now being made. Radiant Lamp Corp., Sherman Ave., Newark, N. J.

■

PITTSBURGH FLUORESCENT UNIT

Fluorescent Unit

New fluorescent Tulamp units for recessed applications. Each unit consists of inverted trough-shaped housing equipped with removable V-trough section which contains knockouts for lampholders, starter sockets and starting switches. V-trough section telescopes into inverted housing where it is held in position by clips. Hinged eggcrate louver, mounted flush with bottom of unit, is designed to mask lamps and eliminate glare from vision. Type RF-236 uses two 30 watt 36-in. lamps and RF-248 uses two 40-watt, 48-in. lamps. Pittsburgh Reflector Company, Oliver Building, Pittsburgh, Pa.

Push Buttons

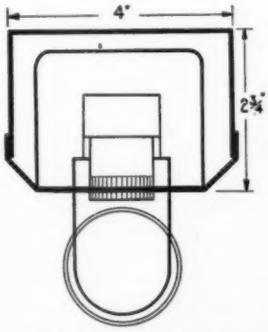
This line of pushbuttons has no screws on the front. They are insulated with impregnated moisture resistant insulators; the contacts are phosphor bronze, self cleaning in operation. They extend $\frac{5}{16}$-in. from wall. Plates are made of heavy brass with antique finish, and are for exterior or interior use. Available in four styles—the Eagle, $1\frac{5}{8}$- by $2\frac{1}{4}$-in.; Oval, $1\frac{3}{4}$- by $2\frac{3}{8}$-in.; Slim, $\frac{3}{4}$- by $1\frac{11}{16}$-in.; and Cardholder $1\frac{3}{4}$- by $1\frac{3}{8}$-in. Edwards and Company, Norwalk, Conn.

EDWARDS OVAL AND CARDHOLDER PUSHES

■

Fluorescent Strip

A new fluorescent strip for the 100-watt lamp. In addition to its uses as a light raceway for coves, displays, illuminated signs, it can also be used as fluorescent ceiling fixture. Some of the features are champfered corners for ceiling light spread; removable lamp starters; can be used for Tulamp ballasts with 1- and $1\frac{1}{2}$-in. diameter lamps as well as $2\frac{1}{4}$-in. Garcy Reflectors Division, Garden City Plating & Mfg. Co., Ogden Blvd. & So. Talman Ave., Chicago, Ill.



GARCY FLUORESCENT STRIP

■

Fluorescent Lamp

A 65-watt 3-foot mazda F lamp has been added to this line. It is recommended for use in stores, offices, hotels and other places where a lamp of about the same brightness and high light output per foot of length as the 5-foot 100-watt size, but of shorter length, is desirable. It is the same diameter as the 100-watt size. Available in 3500° white and daylight colors. Westinghouse Lamp Division, Bloomfield, N. J.

Great News—
The New

UTILITY TESTER

The UTILITY TESTER is a new kind of instrument for testing *all* electrical circuits, and appliances such as — MOTORS, RANGES, HEATERS, IRONERS, WASHERS, SUN LAMPS, TOASTERS, AIR CONDITIONERS, VACUUM CLEANERS, REFRIGERATORS, in fact any and every device that uses an electrical source of current. THE UTILITY TESTER enables *every* possible measurement necessary to service *any* electrical utility.

SPECIFICATIONS:

3 WATTAGE RANGES; A.C. AND D.C. 0-100 Watts 0-1000 Watts 0-5000 Watts.
The UTILITY TESTER reads the wattage consumption (subject to power factor correction) of any appliance, motor, etc., **while it is in operation. This is a feature never before obtainable in any instrument selling for less than $50.**

6 VOLTAGE RANGES; A.C. AND D.C. 0-1 Volt 0-10 Volts 0-50 Volts 0-100 Volts 0-500 Volts 0-1000 Volts.

4 CURRENT RANGES; A.C. AND D.C. 0-1 Ampere 0-10 Amperes 0-50 Amperes 0-100 Amperes.

As far as we know no instrument selling for less than $50.00 has ever enabled current measurements up to 100 Amperes. The UTILITY TESTER provides this service on both A.C. and D.C.

2 RESISTANCE RANGES: 0-300 Ohms 0-3000 Ohms.
The UTILITY TESTER reads all resistances commonly used in electrical appliances and in addition reads extremely low resistances. For instance, $1\frac{1}{2}$ ohms appears on the center of the low ohms scale and resistances as low as 1/50th of an ohm are easily read.
This is a feature never before obtainable in an instrument selling for less than $50.

THE UTILITY TESTER COMES COMPLETE WITH LEADS, PORTABLE COVER, SELF-CONTAINED BATTERY AND INSTRUCTIONS. NOTHING ELSE TO BUY..ONLY $11.85

SUPERIOR INSTRUMENTS CO. 136 LIBERTY ST., DEPT. C4. NEW YORK, N. Y.

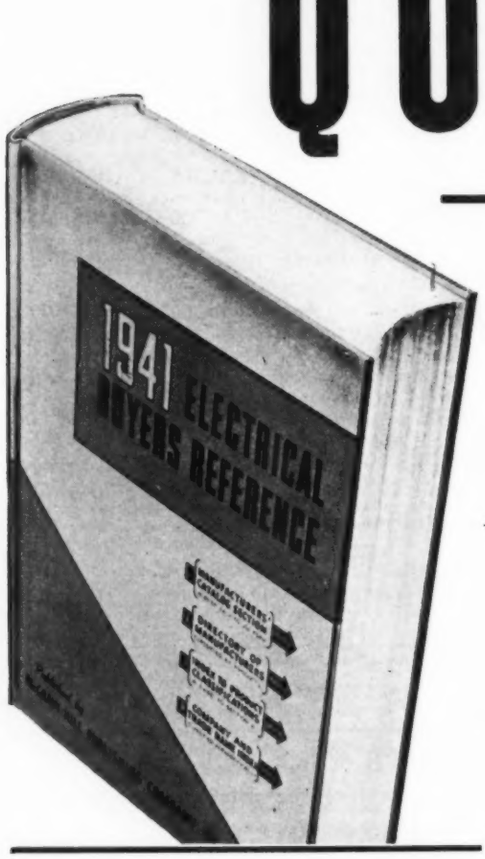
KNOX Weatherholders
a symbol of Satisfaction

There is a size for every need in the KNOX LINE, and you get the best materials and quality workmanship in every piece.

CATALOG, PRICE LISTS and SAMPLES . . . Yours for the asking.

KNOX PORCELAIN CORPORATION
KNOXVILLE, TENNESSEE

QUIZ



Can you name 9 manufacturers of electrical instruments?

THIS BOOK DOES! —and gives catalog data of each of them!

Biddle, Burlington Instrument, Eastern Specialty Co., General Electric, Leeds & Northrup, Roller-Smith, States Co., Westinghouse, Weston—you'll find catalog material from each of these companies in the 1941 Electrical Buyers Reference . . . available for your use, quick as the flip of a page. Information on hundreds of other electrical products is included—552 pages of it . . . plus a lot of other valuable buying information.

Use your Electrical Buyers Reference regularly—to save time and money.

ELECTRICAL BUYERS REFERENCE

A unit of the McGraw-Hill Reference Service

330 West 42nd Street New York, N. Y.

EQUIPMENT NEWS

[FROM PAGE 111]

Oiler

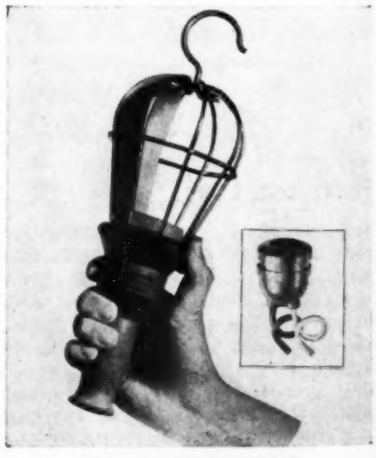
This new oiler is intended for all applications of gravity feed type oilers where dust-proof feature is desirable. It has removable filter that can be extracted for cleaning. Oiler is mounted at top of part to be lubricated and any predetermined number of drops of oil per minute can be obtained by adjustment of needle valve. Shut-off lever at top, when in vertical position, feeds oil, when tilted to side, stops flow. Filler-cap is dust-proof and self-closing. Available in one, two, four and eight ounce capacities. Trico Fuse Mfg. Co., 2948 No. 5th St., Milwaukee, Wis.

TRICO OILER

■

Extension Light

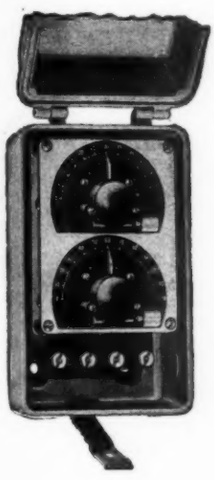
This portable extension light is for use in industrial plants where water, moisture, dust and chemicals present serious problems. The feature of this portable lamp guard is a "Water-Seeled" socket, placed within the rubber handle. To re-lamp, snap rubber ring back, re-lamp, and re-snap ring back into place. Safeguard Electric Co., Inc., 1 DeKalb Avenue, Brooklyn, N. Y.



SAFEGUARD LAMP GUARD

Timer

A new automatic double reset timer has been designed for industrial applications requiring an adjustable and repeating time cycle. It consists of two reset timer mechanisms mounted on a control panel and controlling common electrical circuits. Either conduit or BX type wiring may be used. Housing may be locked as protection against alteration of critical timing of industrial processes. Operation is continuous and according to sequence determined by settings of timers until external control switch is opened. Furnished for 110 or 220 volt and 50 or 60 cycle operation. Time ranges available for each of the individual timers are 15, 30, 60 and 120 seconds. Housing dimensions are 7⅞- by 4¾- by 3¾-in. Knockouts for ¾- and ½-inch conduit are provided. R. W. Cramer Company, Inc., Centerbrook, Conn.

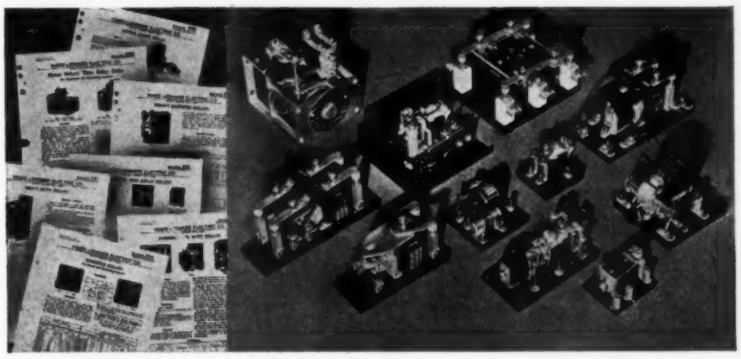


CRAMER TIMER

Lamp Ballasts

This new line of fluorescent lamp ballasts claim to provide performance characteristics that coincide with the requirements of the fluorescent type lamps they are designed to power. They have quick starting and humless operation. Available in designs for single and double lamp applications of 15, 20, 30, 40, 65 and 100 watts. The Acme Electric & Mfg. Co., Cuba, New York.

ACME FLUORESCENT LAMP BALLASTS



7 BULLETINS TELL THE WHOLE

RELAY STORY

A Relay must not only be well designed and well built, but it must also fit the job as to capacity and assembly details for truly efficient operation. Ward Leonard Relays are known for their crisp action, sturdiness and longevity. The scope of the Ward Leonard line permits selection without compromise. Send for Bulletins that are of interest to you.

WARD LEONARD
ELECTRIC COMPANY
28 SOUTH STREET MOUNT VERNON, N. Y.
Electric Control Devices Since 1892

NEW *Fluorescent* LIGHTING *for* EFCOLITE

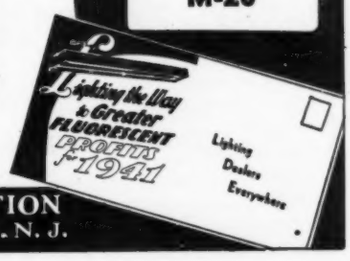
M. 304-48
4-40 Watt Bulbs
High Power Factor

M. 304-24
4-20 Watt Bulbs
High Power Factor

NOW!
***Shadowless* FLUORESCENT—**
THERE'S A REASON WHY THIS NEW, EASY-TO-HANG FLUORESCENT UNIT "SELLS ON SIGHT"

Scientifically shaped reflecting areas eliminate shadows. Chip-proof, Hi-Bake White Enamel reflecting surfaces yield maximum, efficient light. Exterior finishes are smart and durable. All these features and many more, make this and other numbers of the new Efcolite "M" Line the "Best Buy" for 1941.

SEND FOR BULLETIN M-20



Write, Wire, or Phone for information!

EFCOLITE CORPORATION
TRENTON, N. J.

Fluorescent
LAMP FIXTURE

RLM
STANDARD 2-LIGHT FOR 100-WATT LAMP

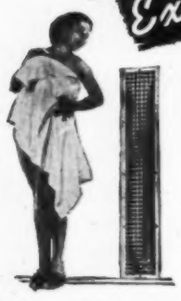
Correctly Designed to give Quality Performance . . .

Covers a light output of 79%—reflector is porcelain enameled grey outside, white inside—control housing is steel finished in aluminum bronze lacquer. Patented lamp holder—an exclusive OAMCO feature—provides safe place for lamp while cleaning reflector. Closed ends shield the lamp. See them at your Wholesaler or send for catalog.

Sign Reflector
Gives even distribution of light over entire sign. Easily removed without disturbing connections.

OVERBAGH & AYRES MFG. CO.
Member of RLM STANDARDS INSTITUTE
411 S. CLINTON ST. CHICAGO, ILL.

EVERY BATHROOM NEEDS THIS *Extra* HEAT



You need this bathroom heat every day in the year. When it's too warm for unit heat or too cold for unit heat alone—Thermador Built-In Bathroom Heaters are the answer. Just a flip of the switch and you are instantly blanketed in flameless, fumeless electric warmth.

***THERMADOR* ELECTRIC BATHROOM HEATERS**

THERMADOR ELECTRICAL MFG CO
5119 So. Riverside Dr., Dept. EC4
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Gentlemen:
Please send me complete contractors specifications and prices.
Name_____
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City_____ State_____

MARTIN *Portable* VISE STAND and PIPE BENDER

Sets up in a half minute and *stands without hitching*

Here is a genuine time-saver for cutting or threading conduit up to 2½". Bending capacity ¾". Carry the Martin Vise Stand and Pipe Bender on the job — it's *really* portable. Write for complete details and prices.

Also made in a larger size—4½" vise capacity with 1" bender capacity.

H. P. MARTIN & SONS
800 W. 12th St. Owensboro, Ky.

TEST-O-LITE

Tests Everything Electrical From 100 to 550 Volts

Indispensable to electricians. Equipped with Neon light which tells instantly where trouble lies in electric circuits, fuses, cut-outs, motors, radios, electric appliances; indicates hot or grounded wires; tells A.C. from D.C.

Only Test-O-Lite, original Neon tester, has exclusive patented safety features. Far superior to clumsy test bulb. Fountain pen size with pocket clip. Useful in homes also. List $1.50 at leading jobbers.

L. S. BRACH
MANUFACTURING CORPORATION
57 Dickerson St., Newark, N. J.

EQUIPMENT NEWS

[FROM PAGE 113]

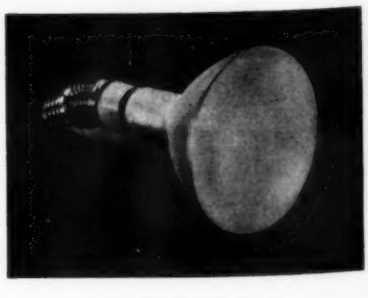
Pipe Cutter

This new pipe tool is a special handle 4-wheel cutter for work in close quarters and for increased cutting speed. The 4 cutting wheels of the new heavy-duty No. 42 provide better balance and handling of cutter under all conditions, cut more evenly and save time in cutting iron, steel or brass pipe, it is claimed. Frame is of malleable alloy, capacity ⅛-in. to 2-in. The Ridge Tool Company, Elyria, Ohio.

RIDGE TOOL PIPE CUTTER

Lamp

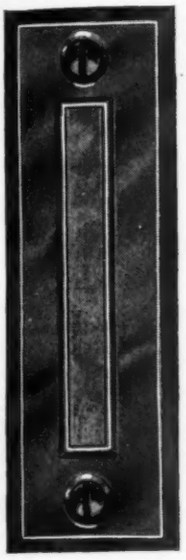
This floodlite is designed for general lighting purposes and delivers a concentrated flood of light in a medium beam. It is an incandescent filament bulb with a lining of silver sealed inside to form a reflecting surface that cannot be dulled or tarnished by dust or fumes. For localized lighting to supplement general illumination, a detachable swivel socket focuses light where needed. It is made in "RE" short bulb, in four sizes and four separate voltages, from 100 to 300 watts and 110 to 125 volts. Birdseye Lamp Sales Division, Wabash Appliance Corporation, 335 Carroll St., Brooklyn, N. Y.



BIRDSEYE FLOODLITE

Bar Push

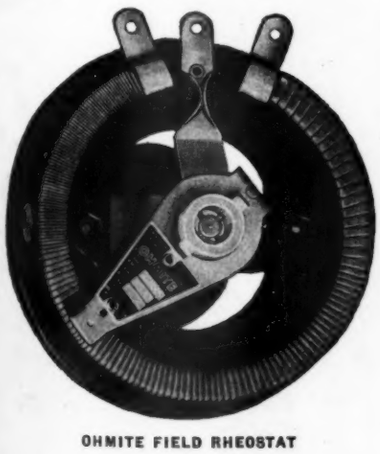
Instead of the usual button, the bar push furnishes a slightly raised bar to push in ringing the bell. Pressure of any point on the bar operates the bar push. It is convenient when one is wearing heavy gloves or carrying a number of parcels. It is made in eight styles and sizes. It is an added item to sell when installing door chimes. The Ansonia Electrical Company, Ansonia, Conn.



ANSONIA BAR PUSH

Rheostat

These generator field control rheostats provide close, gradual control of generator voltage. Recommended for use on portable equipment, such as welding generators, home lighting plant generators, also on shipboard, trains, airplanes and automotive equipment. Rheostats are tapered or wound, as required, designed to provide control for separately or self-excited generators. Available in a series of ten wattage sizes, from 25 to 1000 watts. By connecting them in tandem, range can be extended further. Ohmite Manufacturing Company, 4835 Flournoy St., Chicago, Ill.



OHMITE FIELD RHEOSTAT

TO BE SURE

of a

FIRM, RIGID INSTALLATION

USE

KWIKON

SET SCREW

"E.M.T." Fittings

As the set screws are driven down they indent the conduit and securely lock conduit and fittings together. Pull out capacity is far beyond extreme requirements.

The long chamber of fitting insures a conduit system that lines up straight as a string from outlet to outlet—no sags or unsightly droops when Kwikon fittings are used.

APPROVED BY UNDERWRITERS' LABORATORIES, INC.

KWIKON CO. 1850 WASHINGTON BLVD. CHICAGO, ILLINOIS

Sheldon

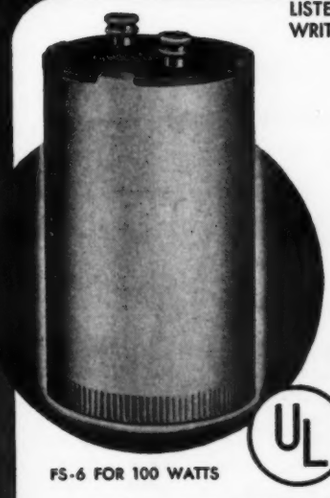
the name for dependable

STARTER SWITCHES

LISTED AS STANDARD BY UNDERWRITERS' LABORATORIES, INC.

FS-2 FOR 15 & 20 WATTS

FS-4 FOR 30 & 40 WATTS



FS-6 FOR 100 WATTS

Precision and performance have established a reputation of quality for Sheldon starter switches. The name Sheldon is your assurance of a pretested, faster starting, quality switch that will perform with uniform precision at all times.

Write for full details

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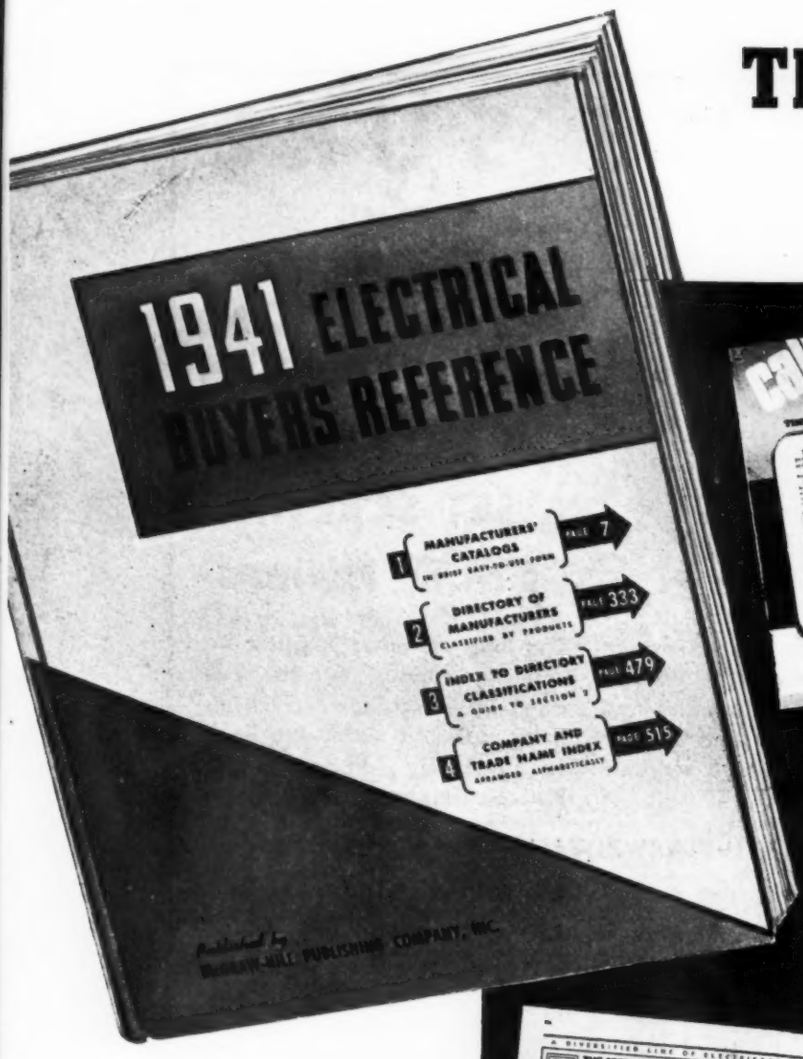
Take lighting equipmen


1941 ELECTRICAL BUYERS REFERENCE
1 MANUFACTURERS' CATALOGS IN QUICK EASY-TO-USE FORM PAGE 7
2 DIRECTORY OF MANUFACTURERS CLASSIFIED BY PRODUCTS PAGE 333
3 INDEX TO DIRECTORY CLASSIFICATIONS A GUIDE TO SECTION 2 PAGE 479
4 COMPANY AND TRADE NAME INDEX ARRANGED ALPHABETICALLY PAGE 515
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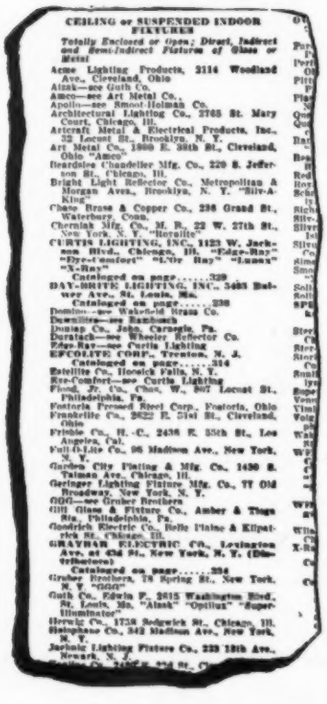

CEILING or SUSPENDED INDOOR FIXTURES

Totally Enclosed or Open; Direct, Indirect and Semi-Indirect Fixtures of Glass or Metal

Acme Lighting Products, 2114 Woodland Ave., Cleveland, Ohio
Alzak—see Guth Co.
Amco—see Art Metal Co.
Apollo—see Smoot-Holman Co.
Architectural Lighting Co., 2705 St. Mary Court, Chicago, Ill.
Artcraft Metal & Electrical Products, Inc., 53 Locust St., Brooklyn, N. Y.
Art Metal Co., 1900 E. 36th St., Cleveland, Ohio "Amco"
Beardsley Chandelier Mfg. Co., 220 S. Jefferson St., Chicago, Ill.
Bright Light Reflector Co., Metropolitan Ave. & Morgan Aves., Brooklyn, N. Y. "Biv-A-Ray"
Chase Brass & Copper Co., 236 Grand St., Waterbury, Conn.
Chemisk Mfg. Co., M. R., 22 W. 27th St., New York, N. Y. "Heroilite"
CURTIS LIGHTING, INC., 1123 W. Jackson Blvd., Chicago, Ill. "Edge-Ray" "Eye-Comfort" "L'Or Ray" "Lunex" "X-Ray"
Catalogued on page.....328
DAY-BRITE LIGHTING, INC., 5403 Bulwer Ave., St. Louis, Mo.
Catalogued on page.....330
Dominion—see Wakefield Brass Co.
Downlighter—see Rambusch
Dunlap Co., John, Carnegie, Pa.
Duralack—see Wheeler Reflector Co.
Eye-Ray—see Curtis Lighting
EFCOLITE CORP., Trenton, N. J.
Catalogued on page.....314
Estelite Co., Hoosick Falls, N. Y.
Eye-Comfort—see Curtis Lighting
Fessel, Jr. Co., Chas. W., 2017 Locust St., Philadelphia, Pa.
Fostoria Pressed Steel Corp., Fostoria, Ohio
Frankrite Co., 2822 E. 51st St., Cleveland, Ohio
Fryside Co., H.-C., 2436 E. 55th St., Los Angeles, Cal.
Full-O-Lite Co., 96 Madison Ave., New York, N. Y.
Gardner City Plating & Mfg. Co., 1430 S. Talman Ave., Chicago, Ill.
Geringer Lighting Fixture Mfg. Co., 77 Old Broadway, New York, N. Y.
GGG—see Gruber Brothers
Gill Glass & Fixture Co., Amber & Tiago Sts., Philadelphia, Pa.
Glenrich Electric Co., Belle Plaine & Kilpatrick Sts., Chicago, Ill.
GRAYBAR ELECTRIC CO., Lexington Ave. at 43d St., New York, N. Y. (Distributors)
Catalogued on page.....334
Gruber Brothers, 78 Spring St., New York, N. Y. "Alzak"
Guth Co., Edwin F., 2615 Washington Blvd., St. Louis, Mo. "Alzak" "Optilux" "Super-Illuminator"
Herwig Co., 1738 Sedgwick St., Chicago, Ill.
Holophane Co., Inc., 342 Madison Ave., New York, N. Y.
Jarkuic Lighting Fixture Co., 220 18th Ave., Newark, N. J.

From the product classified listing. The bold face refers you to the manufacturers' catalogs.

questions on hundreds of products

for example ➘

558 PAGES of reference and catalog data make Electrical Buyers Reference the most valuable book in your office. It's a closet-full of catalogs in *one* handy, thoroughly indexed volume.

Suppose it's lighting data you're after . . .

FIRST: 30 leading manufacturers of lighting fixtures have condensed catalogs in the front of the book . . . specifications, offices, representatives, etc.

SECOND: there's a *product-classified* list of manufacturers — 10 columns under "Lighting Fixtures" alone.

THIRD: The product classifications are *completely* indexed and cross-indexed; and . . .

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Reproduced on these pages are glimpses of the catalog data which lighting manufacturers have included . . . just to give you an idea of the *completeness* of this book.

Right! Electrical Buyers Reference has a wealth of information you need on lighting — and on hundreds of other products.

During these extra-busy days you'll find Electrical Buyers Reference a real time saver!

McGRAW-HILL PUBLISHING COMPANY, INC.

330 WEST 42nd STREET
NEW YORK, N. Y.

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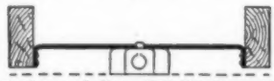
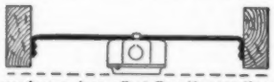
Licensed Under Pat. No. 2233334

Takes the place of three: Straight, Shallow off-set and Deep off-set Bar Hanger.

Eliminates a bulge appearing on the surface of Plaster Board, Sheet Rock, Beaver Board, etc., because it is nailed between the studding or joists.



When used as a shallow offset Bar Hanger line up the end legs flush with the bottom of the joists.



When used as a deep offset Bar Hanger line up the end legs 5/8" back from the bottom of the joists.

When used as a Straight Bar Hanger reverse the stud and line up the bar flush with the bottom of the joist.

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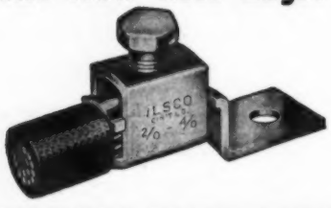

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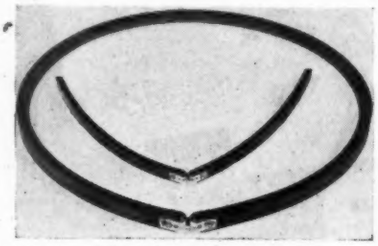
EQUIPMENT News

[FROM PAGE 115]

V-Belting

A new line of open-end V-belting for application on drives where endless V-belts cannot be applied has been developed. Made in maximum 50 foot lengths, the open-end V-belting is made in top widths of $\frac{31}{32}$-in., $\frac{7}{8}$-in. and $1\frac{1}{4}$-in. and in thicknesses of $\frac{7}{16}$-in., $\frac{5}{8}$-in. and $\frac{3}{4}$-in. Angle in each case is 40 degrees. Metal fasteners are used. B. F. Goodrich Company, Akron, Ohio.

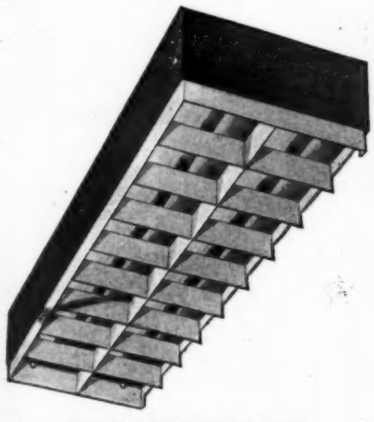


GOODRICH V-BELTING

■

Show Window Units

A new line of fluorescent show window lighting units has been designed. The five-foot size uses the new 60-inch fluorescent lamp in each of the two reflectors. The three-foot size mounts four 36-inch lamps—two lamps are placed one above the other in each reflector. In both sizes the unit has two asymmetric reflectors which direct light down on the display area. Provision has been made for recessing into ceiling and also for installing units end-to-end in continuous lines or side-by-side. Can be obtained with or without louvers. Larger size has 235-watt rating and smaller one 150-watt. Curtis Lighting, Inc., 1123 West Jackson Blvd., Chicago, Ill.



CURTIS FLUORESCENT UNITS

SEARCHLIGHT SECTION

(Classified Advertising)

Employment : : Equipment
Business : : (Used or Resale)

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3—1½ HP Ditto Westinghouse

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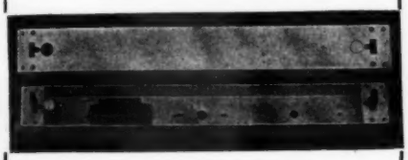

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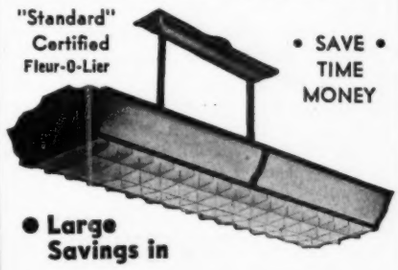

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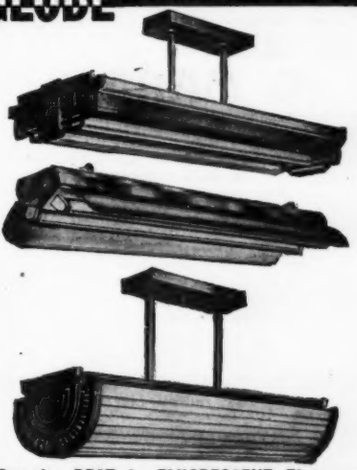

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See the Globe "Flurolume" Line at your local wholesaler . . . These fixtures not only represent the latest advances in scientific fluorescent illumination—they offer exclusive advantages that boost sales, improve volume and increase profits.

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NELTO FLUORESCENT
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A GOOD Habit

The Where-To-Buy Section of Electrical Contracting supplements other advertising in this issue with these additional announcements of products and materials of special interest and application in the field of electrical construction, maintenance and repair work. Make a habit of checking this page each issue—a *good* habit!

LOW VOLTAGE TATTELITE

Range 3 to 25 volts. Tests automotive currents on aeroplanes, autos, trucks, etc.; telephones, temperature controls, doorbell circuits, radio, continuity tests where low voltage is used. Pocket size, sturdy. Price $1.75 each.

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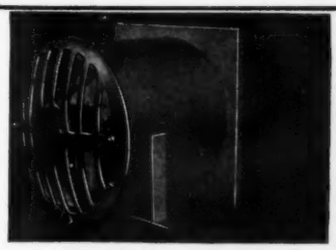

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New WHERE TO BUY Advertisements

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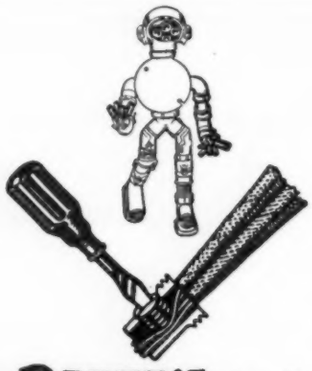

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solderless connector cheaper and better than with tape, solder and torch."

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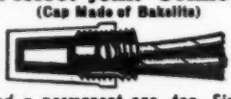

. . . and a permanent one, too. Simply insert the wires, turn on bakelite cap, and tighten with the screw driver.

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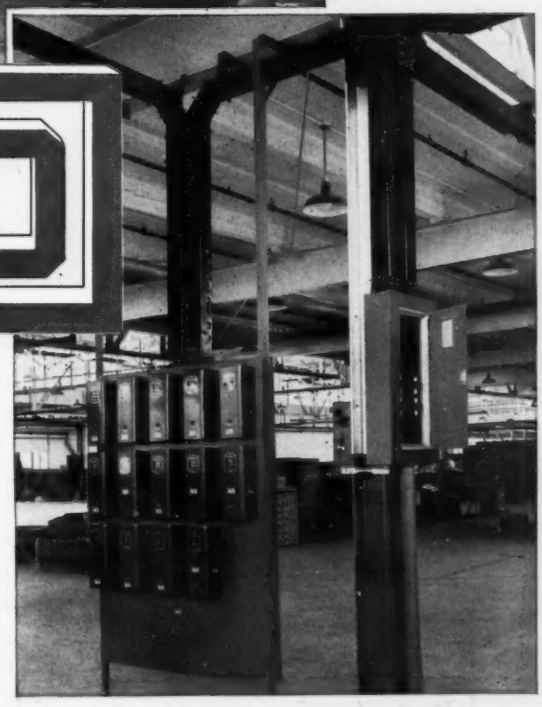

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Don't underestimate the tremendous possibilities of SQUARE-Duct installations, especially during this period of industrial building and expansion.

TOP ILLUSTRATION. Rows of punch presses are lined up under the runs of SQUARE-Duct. Machines are located to best advantage and new machines can be added with a minimum of time and expense.

LOWER ILLUSTRATION. Circuit breaker power panel and remote control magnetic starters. Again, notice the SQUARE-Duct which runs the length and breadth of the plant.

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SQUARE D COMPANY

DETROIT - MILWAUKEE - LOS ANGELES

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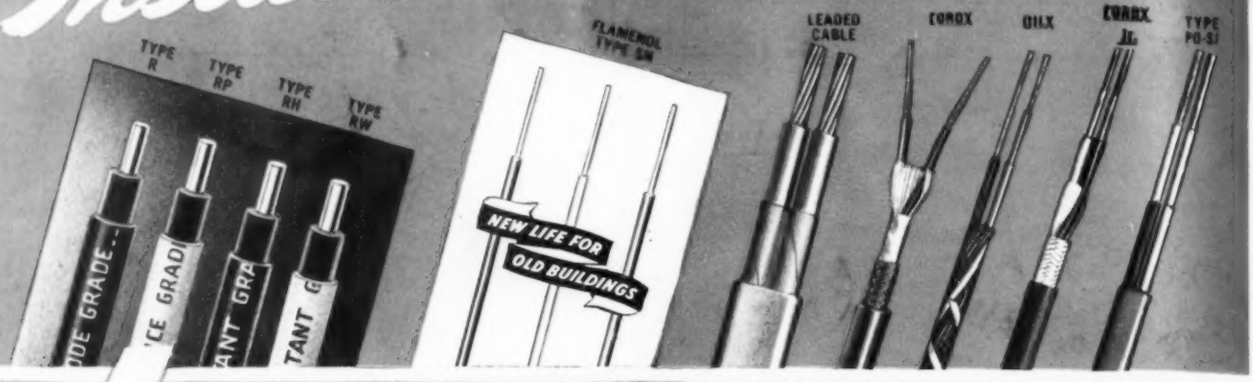
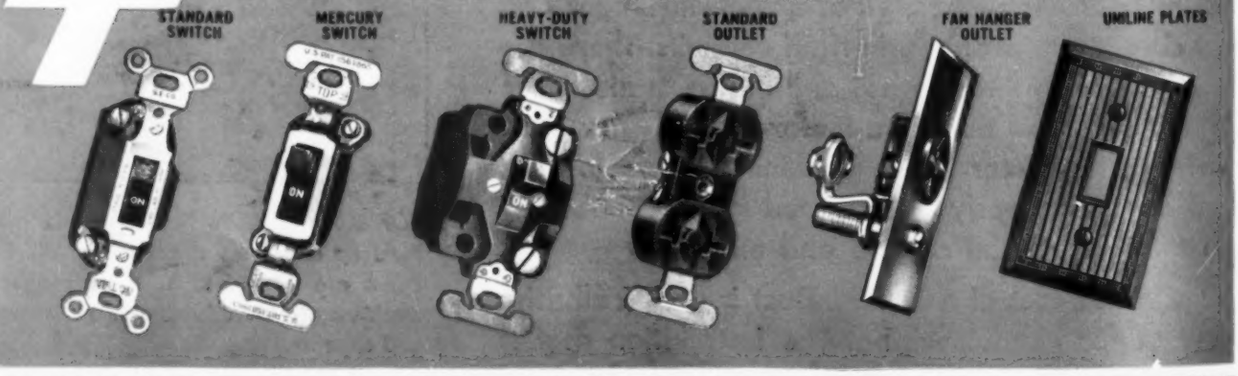


+ G-E CONDUIT PRODUCTS

+ G-E WIRING DEVICES



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For information on G-E wiring materials see the nearest G-E Merchandise Distributor or write to Section CDW-183, Appliance and Merchandise Dept., General Electric Co., Bridgeport, Conn.

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